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Aeronautical Engineering
A Continuing Bibliography with Indexes

NASA SP-7037 (122)
May 1980

National Aeronautics and Space Administration

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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)	N80-16023 – N80-17980
IAA (A-10000 Series)	A80-21041 – A80-24720

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NASA SP-7037(122)

AERONAUTICAL ENGINEERING

A Continuing Bibliography

Supplement 122

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in April 1980 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

Scientific and Technical Information Branch 1980
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INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering. The first issue of this bibliography was published in September 1970 and the first supplement in January 1971. Since that time, monthly supplements have been issued.

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 303 reports, journal articles, and other documents originally announced in April 1980 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*.

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* and *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

Three indexes -- subject, personal author, and contract number -- are included.

An annual cumulative index will be published.

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All publications abstracted in this bibliography are available to the public through the sources as indicated in the *STAR Entries* and *IAA Entries* sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover.

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N80-10148*# Northwestern Univ., Evanston, Ill. Transportation Center.
FACTORS AFFECTING THE RETIREMENT OF COMMERCIAL TRANSPORT JET AIRCRAFT
Frank A. Spencer Aug. 1979 296 p refs
(Grant NsG-2149)
(NASA-CR-152308) Avail: NTIS HC A13/MF A01
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The historical background of the technology and economics of aircraft replacement and retirement in the prejet era is reviewed in order to determine whether useful insights can be obtained applicable to the jet era. Significant differences between the two periods are noted. New factors are identified and examined. Topics discussed include concern over current policies regarding deregulation, regulatory reform, and retroactive noise regulations; financing and compliance legislation; aging; economic environment and inflation; technological progress; fuel efficiency and cost; and a financial perspective of replacement decisions. A.R.H.

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A80-10196 # **Effect of flow swirling on heat transfer in the cylindrical part of the prenozzle volume of a model chamber (Vliianie zakrutki potoka na teplootdachu v tsilindricheskoi chasti predsoplovogo ob'ema model'noi kamery).** F. I. Sharafutdinov, A. I. Mironov, and V. K. Shchukin (Kazanskii Aviatsionnyi Institut, Kazan, USSR). *Inzhenerno-Fizicheskii Zhurnal,* vol. 37, Oct. 1979, p. 595-601. 8 refs. In Russian.

Experimental results are presented on the hydrodynamics and heat transfer in swirling flow in a short orificed tube with straight-blade turbilizers. Data are correlated by the local simulation method, employing the maximum axial component of wall gas velocity and the torque momentum/axial momentum ratio at the turbilizer outlet. B.J.

AERONAUTICAL ENGINEERING

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IAA ENTRIES

A80-21052 # **Determination of start-up pressure losses for gas-turbine engine compressors (Opredelenie poter' davleniia kompressora GTD na rezhimakh puska).** L. I. Slobodianiuk and V. I. Daineko (Sevastopol'skii Priborostroitel'nyi Institut, Sevastopol, Ukrainian SSR). *Energetika,* vol. 22, Oct. 1979, p. 97-99. In Russian.

In order to calculate the start-up conditions for gas-turbine engines with several compressors, it is necessary to know the hydraulic resistance of the compressors. In the present paper, an expression for calculating the hydraulic resistance is derived. It can be used to calculate the influence of air temperature and pressure at the compressor inlet and the Mach number (or any other gasdynamic function expressed in terms of the Mach number) in the basic section under rated conditions for calculating the gasdynamic characteristics of a given compressor. V.P.

A80-21096 # **Vibrations of a rotating deformable disk (Kolebaniia vrashchaiushchegosia deformiruemogo diska).** M. Iu. Ochan. *Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela,* Sept.-Oct. 1979, p. 65-71. In Russian.

An expression for the critical spinning rate is derived for a tape-wound rotor consisting of a large number of concentric rings held together by a binder. It is shown that even for a perfectly balanced rotor of ideal geometry, uniformly distributed radial tensile stresses, induced by spinning, will act on the filler, causing it to fail (by layer separation) at high speeds. A means of avoiding failure, is to use binders with a very small modulus of elasticity, however, a lower limit on the modulus of elasticity is placed by resonance considerations, since in the presence of resonance, even the smallest imbalance will lead to failure of the binder and the rotor itself. V.P.

A80-21120 * # **Some dynamic and time-averaged flow measurements in a turbine rig.** L. N. Krause and G. C. Fralick (NASA, Lewis Research Center, Cleveland, Ohio). *ASME, Transactions, Journal of Engineering for Power,* vol. 102, Jan. 1980, p. 223, 224. 5 refs.

Four types of sensors were used to make both dynamic and time-averaged flow measurements in a cold turbine rig to determine the magnitude of errors in time-averaged total-pressure measurement at a station 5 1/2 blade cords downstream from the rotor. The errors turned out to be negligible. The sensors and their intended use are discussed. (Author)

A80-21121 **Airport capacity and delays.** G. F. Newell (California, University, Berkeley, Calif.). *Transportation Science,* vol. 13, Aug. 1979, p. 201-241. 6 refs.

A survey and critique of existing literature on airport capacity is presented. The purpose is to describe how the capacity of a runway configuration depends on the strategy for sequencing various types of operations such as heavy or light arriving or departing aircraft, as well as the runway geometry and the instrument flight rules. Attention is given to the formulas for traffic flows and aircraft capacities. C.F.W.

A80-21122 * # **A spin-recovery parachute system for light general aviation airplanes.** C. F. Bradshaw (NASA, Langley Research Center, Hampton, Va.). *NASA Langley Research Center, Aerospace Mechanisms Symposium, 14th, Hampton, Va., May 1, 2, 1980, Paper.* 16 p.

A tail-mounted spin-recovery parachute system has been designed and developed by the NASA Langley Research Center for use on light general aviation airplanes. The system was designed for use on typical airplane configurations, including low-wing, high-wing, single- and twin-engine designs. A mechanically triggered pyrotechnic slug gun is used to forcibly deploy a pilot parachute which extracts a bag that deploys a ring-slot spin-recovery parachute. The total system weighs 8.2 kg (18 lb). System design factors included airplane wake effects on parachute deployment, prevention of premature parachute deployment, positive parachute jettison, compact size, low weight, system reliability, and pilot and ground crew safety. Extensive ground tests were conducted to qualify the system. The recovery parachute has been used successfully in flight 17 times. (Author)

A80-21126 **Composite materials: Testing and design; Proceedings of the Fifth Conference, New Orleans, La., March 20-22, 1978.** Conference sponsored by the American Society for Testing and Materials. Edited by S. W. Tsai (USAF, Materials Laboratory, Wright-Patterson AFB, Ohio). Philadelphia, Pa., American Society for Testing and Materials (ASTM Special Technical Publication, No. 674), 1979. 696 p. $52.50.

The Conference focused on composite applications, design and data, testing and evaluation, environmental effects, fatigue, physiochemical properties, and failure mechanisms. Papers were presented on composites for aerospace applications, minimum weight design in double-layer panels: sheet molding compound vs steel, fabrication and nondestructive evaluation of an advanced composite foil test component, effect of near-visual damage on the properties of graphite/epoxy, dispersion of elastic waves and the nondestructive testing of composites, environmental effects on epoxy matrix composites, fatigue behavior and life prediction of composite laminates, physiochemical characterization of composites and quality control of raw materials, fatigue damage in boron-aluminum and delamination crack growth in unidirectional fiber-reinforced composites under static and cyclic loading. A.T.

A80-21127 **Composites for aerospace applications.** S. J. Dastin (Grumman Aerospace Corp., Bethpage, N.Y.). In: Composite materials: Testing and design; Proceedings of the Fifth Conference, New Orleans, La., March 20-22, 1978. Philadelphia, Pa., American Society for Testing and Materials, 1979, p. 5-13. 5 refs.

A review of composites for aerospace applications is presented. Advanced composites have been established as a primary structural material for aerospace applications, and large volume applications for

graphite and aramid fibers are forecast. Current U.S. military aircraft, such as F-14, F-15, and F-16, utilize composites for empennage components, and future commercial aircraft will use these materials to reduce weight and save fuel. Composites were utilized to fabricate the payload bay doors for the Space Shuttle Orbiter, and composite tubular structures of near-zero thermal coefficient were used for the large space telescope; other aircraft areas being evaluated for composite application are floor beams, decks, and engine components. A.T.

A80-21129 **Advanced composite material applications to F-14A structure.** H. Forsch (Grumman Aerospace Corp., Bethpage, N.Y.). In: Composite materials: Testing and design; Proceedings of the Fifth Conference, New Orleans, La., March 20-22, 1978. Philadelphia, Pa., American Society for Testing and Materials, 1979, p. 30-39.

This paper presents a review of the advanced composite material applications to the F-14 aircraft. These composite applications include the boron/epoxy horizontal stabilizer, and the hybrid advanced composite over-wing fairing and main landing gear door. A brief design review of each of these components is presented together with the program payoffs. A summary of composite horizontal stabilizer production and service experience also is presented and compared to typical metal aircraft service data. (Author)

A80-21130 * **Characterization of graphite/epoxy laminates for aeroelastic tailoring.** P. Shyprykevich (Grumman Aerospace Corp., Bethpage, N.Y.). In: Composite materials: Testing and design; Proceedings of the Fifth Conference, New Orleans, La., March 20-22, 1978. Philadelphia, Pa., American Society for Testing and Materials, 1979, p. 40-56. 6 refs. Contract No. NAS1-14759.

A study of interaction between wing bending and twist by graphite/epoxy anisotropic laminates used in aircraft wing skins is presented. The laminates were used as covers for subscale box beams supported as a cantilever and tested in tip shear and tip torque, measuring beam response with a reflected light technique. The results indicated that the in-plane stiffness properties of anisotropic laminates can be predicted if the layer properties of the composite materials are known; thus, the coupled bending/twist response of wing type structures made from these laminates can be determined provided the limits of the laminate linear behavior are not significantly exceeded. A.T.

A80-21136 **Fatigue data on a variety of nonwoven glass composites for helicopter rotor blades.** J. W. Davis and G. J. Sundsrud (3M Co., Industrial Specialties Div., St. Paul, Minn.). In: Composite materials: Testing and design; Proceedings of the Fifth Conference, New Orleans, La., March 20-22, 1978. Philadelphia, Pa., American Society for Testing and Materials, 1979, p. 137-148.

The paper examines fatigue test data to determine the effects of the nonwoven glass composite raw material variables on properties required for helicopter rotor blades. Thirty alternating stress vs cycles to failure (S-N) curves were developed for the glass type, glass fiber finish, suppliers, fiber bundle size, and resins used for glass fiber/epoxy composites. The S-N curves indicated differences in the reproducibility and data scatter for a unidirectional, 0-deg, and a bias, plus or minus 45 deg orientations in tensile-tensile fatigue tests, with the 0-deg producing greater data scatter, and the 45-deg giving greater spread between variables. Finally, significant differences due to glass finish, fiber bundle size, and resins were observed. A.T.

A80-21224 * # **Toward new small transports for commuter airlines.** D. J. Giulianetti and L. J. Williams (NASA, Ames Research Center, Moffett Field, Calif.). *Astronautics and Aeronautics,* vol. 18, Feb. 1980, p. 16-25. 7 refs.

The article discusses the results of a survey of commuter airline operators and large and small airframe manufacturers conducted by the Small Transport Aircraft Technology Office of the NASA Ames Research Center. Attention is given to economic concerns of the operator and manufacturer, as well as social concerns of the passenger, community, and system. Discussion also covers research and technology opportunities for improving commuter aircraft, and provides a background of information on the commuter and short-haul local-service air carriers, regulations pertaining to their aircraft, and operations, overall airline interfaces, and facility requirements. M.E.P.

A80-21225 * # **Small Transport Aircraft Technology.** T. L. Galloway (NASA, Ames Research Center, Moffett Field, Calif.). *Astronautics and Aeronautics,* vol. 18, Feb. 1980, p. 26-35.

The article surveys the results of the NASA-instituted Small Transport Aircraft Technology (STAT) research effort aimed at generating advanced technologies for application to new small, short haul transports having significantly better performance, efficiency, and environmental compatibility. Discussion covers fuselage designs and bonded aluminum-honeycomb wing construction which reduces the number of parts and fasteners, and gives a smoother outer contour. Topics discussed include: advanced aluminum alloys, composite primary structures, propellers, engine components, icing protection, avionics, flight controls, aerodynamics, and gust load alleviation. M.E.P.

A80-21228 * # **Aerobraking and aerocapture for planetary missions.** J. R. French and M. I. Cruz (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Astronautics and Aeronautics,* vol. 18, Feb. 1980, p. 48-55, 71. Contract No. NAS7-100.

The paper examines the utilization of aerodynamic forces to capture a vehicle into a closed orbit and/or to modify an orbit. Attention is given to two techniques: aerobraking which uses drag during successive passes through the upper atmosphere to circularize a highly elliptical orbit, and aerocapture which transfers a vehicle into a closed stable orbit from a hyperbolic flyby trajectory. Sample missions employing both techniques are discussed. M.E.P.

A80-21232 **Analysis of two-dimensional interactions between shock waves and boundary layers.** T. C. Adamson, Jr. and A. F. Messiter (Michigan, University, Ann Arbor, Mich.). In: Annual review of fluid mechanics. Volume 12. Palo Alto, Calif., Annual Reviews, Inc., 1980, p. 103-138. 150 refs.

The paper reviews recent analytical and numerical results on the interaction of shock waves and boundary layers. Shock wave interaction with laminar boundary layers is considered with emphasis on the asymptotic theory of free interactions, incident oblique shock waves, and corners and steps. Asymptotic and numerical methods for treating interaction with turbulent boundary layers are also discussed. Some experimental results on the interactions are also examined. B.J.

A80-21233 **Transonic flow past oscillating airfoils.** H. Tijdeman (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands) and R. Seebass (Arizona, University, Tucson, Ariz.). In: Annual review of fluid mechanics. Volume 12. Palo Alto, Calif., Annual Reviews, Inc., 1980, p. 181-222. 90 refs. Research supported by the Nationaal Lucht- en Ruimtevaartlaboratorium, U.S. Air Force, and U. S. Navy.

The nature of transonic flow past oscillating airfoils is described, and recent developments concerning unsteady transonic flow calculations are reviewed. Experimental results are examined and used to illustrate the interaction between steady and unsteady flow fields, the periodic motion of shock waves, and the effects of frequency and amplitude of oscillation. Attention is then given to the inviscid equations forming the basis of the various theoretical methods.

Viscous effects and calculation methods are also discussed. Finally, the current status of the field is reviewed and expected developments are examined. B.J.

A80-21238 **Reliability of aircraft mechanical systems and equipment; Proceedings of the Conference, London, England, September 20, 1978.** Conference sponsored by the Institution of Mechanical Engineers, Ministry of Defence, and Royal Aeronautical Society. London, Mechanical Engineering Publications, Ltd. (I Mech E Conference Publications, No. 1978-9), 1978. 41 p. $15.

The paper deals with reliability of aircraft mechanical systems and equipment with emphasis placed on military aircraft. The nature of aircraft and complex system reliability and maintainability characteristics are studied along with the reliability of various fuel, hydraulic, and air conditioning components. A study of the installed environment of various equipment in military aircraft is presented as well as an investigation into reliability and cost of ownership of the Plessey air motor servo unit. V.T.

A80-21239 **The nature of aircraft and complex system reliability and maintainability characteristics.** P. H. Reed (Ministry of Defence /Procurement Executive/, London, England). In: Reliability of aircraft mechanical systems and equipment; Proceedings of the Conference, London, England, September 20, 1978. London, Mechanical Engineering Publications, Ltd., 1978, p. 1-9. 8 refs. Research supported by the Ministry of Defence (Procurement Executive).

The paper describes Operational Reliability Trials (1961-1968) of a wide range of UK military aircraft. Several generalized reliability and maintainability (R and M) characteristics applicable to aircraft and aircraft systems are determined. The trials undertaken are briefly discussed, the nature of the R and M characteristics found, and their implication for economic complex systems reliability demonstration testing is outlined. V.T.

A80-21240 **Investigation into the reliability of various fuel; hydraulic and air conditioning components in military aircraft.** G. Jones (British Aerospace, Brough, Yorks., England). In: Reliability of aircraft mechanical systems and equipment; Proceedings of the Conference, London, England, September 20, 1978. London, Mechanical Engineering Publication, Ltd., 1978, p. 11-16. Research supported by the Ministry of Defence (Procurement Executive).

British Aerospace Brough have been engaged in a study, funded by Ministry of Defence (Procurement Executive), which has reviewed the life history of a number of mechanical systems and components used on military aircraft. The investigation concentrated on the engineering causes of unreliability in service, rather than reviewing statistical data. The study covered all aspects of the specification, design, testing and operational use of components employed in the fuel, hydraulic and air systems. It has been possible to identify the major causes of unreliability in service, and to make recommendations as to which part of the design process needs to be improved in order to reduce life cycle costs. (Author)

A80-21241 **Investigation into the reliability and cost of ownership of the Plessey air motor servo unit - Type 306.** P. G. Haite (Plessey Aerospace, Ltd., Titchfield, Hants., England). In: Reliability of aircraft mechanical systems and equipment; Proceedings of the Conference, London, England, September 20, 1978. London, Mechanical Engineering Publications, Ltd., 1978, p. 31-37. Research supported by the Ministry of Defence (Procurement Executive).

The reliability and cost of ownership of an air motor servo unit have been analyzed to provide information which may be used in compiling the specifications for future similar technical components. The air motor servo unit is a major mechanical component used to control engine nozzle position on the Harrier aircraft. Description of the unit is presented along with design philosophy, development, service, defect, and modification history. It is noted that technical and commercial specifications for mechanical systems should be closely linked to ensure that reliability objectives are clearly stated and pursued throughout the life of the aircraft to the benefit of the total cost of ownership. V.T.

A80-21255 # **Calculation of the aerodynamic characteristics of an aircraft at supersonic speeds (Raschet aerodinamicheskikh kharakteristik samoleta pri sverkhzvukovykh skorostiakh).** N. A. Kudriavtseva and N. G. Lavrenko. *TsAGI, Uchenye Zapiski,* vol. 9, no. 1, 1978, p. 11-18. 14 refs. In Russian.

A method is proposed for calculating the aerodynamic behavior of an aircraft both in steady motion and in the case of variable kinematic parameters, such as the angle of attack and angular velocity, from harmonic laws with vanishing Strouhal numbers. The velocity potential of sources situated in one of the datum planes is determined. The accuracy of the aerodynamic computations is assessed on the basis of the reciprocity theorem. The computed loads, forces, and moments are compared with experimental data. V.P.

A80-21260 # **Improvement of control system dynamics of means of additional hydraulic load feedback (Uluchshenie dinamiki sistemy upravleniia s pomoshch'iu dopolnitel'noi obratnoi sviazi po nagruzke slediashchego gidroprivoda).** A. F. Beliakov, Iu. A. Boris, L. M. Koriakin, and M. I. Rabinovich. *TsAGI, Uchenye Zapiski,* vol. 9, no. 1, 1978, p. 57-70. 7 refs. In Russian.

The paper presents a computer-aided analysis of the dynamics of hydraulic control servomechanisms. Using a minimum of simplifying assumptions, it is shown that the speed of operation, damping, and dynamic precision of hydraulic servomechanisms can be considerably improved by introducing an additional load feedback. V.P.

A80-21264 # **A nonlinear problem of static aeroelasticity (Nelineinaia zadacha staticheskoi aerouprugosti).** Iu. P. Nushtaev. *TsAGI, Uchenye Zapiski,* vol. 9, no. 1, 1978, p. 92-100. In Russian.

A numerical analysis is carried out for steady inviscid transonic flow over an elastically fixed wing profile with aileron. The behavior of the angle of elastic rotation of the wing profile, caused by changes in the freestream Mach number, is studied for wing profile under an angle of attack. The influence of elasticity on the efficiency of a wing with aileron is evaluated. V.P.

A80-21272 # **A panel method for calculating the loads acting on a wing that performs harmonic oscillations in subsonic flow (Panel'nyi metod rascheta nagruzok, deistvuiushchikh na krylo, sovershaiushchee garmonicheskie kolebaniia v dozvukovom potoke).** P. M. Gostev, A. S. Kutin, and V. V. Mozzhilkin. *TsAGI, Uchenye Zapiski,* vol. 9, no. 2, 1978, p. 27-35. 14 refs. In Russian.

A numerical method is proposed for solving the integral equation for the velocity-potential jump on a lifting surface performing small harmonic oscillations in subsonic flow. An algorithm which makes it possible to carry out the calculations using arbitrary trapezoidal panels is outlined. The pressure differential on rectangular and swept wings is calculated for various mode shapes of vibration over a range of Mach and Strouhal numbers. The rapid convergence of the method is demonstrated by examples. V.P.

A80-21276 # **Application of the variational-difference method of straight lines to the calculation of wing middle surface deformation (Primenenie variatsionno-raznostnogo metoda priamykh k raschetu deformatsii sredinnoi poverkhnosti kryla).** V. A. Belous. *TsAGI, Uchenye Zapiski,* vol. 9, no. 2, 1978, p. 87-93. 5 refs. In Russian.

In the present paper, the variational-difference method of straight lines is used to calculate the stress-strain state of the middle surface of a small-aspect wing. The basic relations of the method are examined, and the accuracy of the method is assessed from data obtained for triangular cantilever plates. V.P.

A80-21279 # **Development of a program for controlling the angle of bank of an orbital aircraft during entry into the atmosphere (Postroenie programmy upravleniia uglom krena orbital'nogo samoleta pri spuske v atmosfere).** N. A. Odinenko, V. P. Plokhikh, Iu. V. Shiranov, and L. M. Shkadov. *TsAGI, Uchenye Zapiski,* vol. 9, no. 2, 1978, p. 117-121. In Russian.

Some aspects of selecting the control law for the angle of bank at reentry for a shuttle-type craft with an aspect ratio greater than unity are discussed. The control law deduced from the analysis is shown to provide a near-threshold lateral range of descent at which a certain level of aerodynamic heating is not exceeded. V.P.

A80-21283 # **Calculation of the flow past a body of arbitrary configuration, moving in an ideal fluid above a flat surface (Raschet obtekaniia tela proizvol'noi formy, dvizhushchegosia v ideal'noi zhidkosti nad ploskim ekranom).** S. V. Egoshin. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 1-9. 7 refs. In Russian.

In the present paper, a method proposed by Maslov and Iushin (1976) for calculating flows over three-dimensional fuselages is applied to the calculation of potential flow about arbitrary body shapes near a plane wall. The wall effect is simulated by a mirror-image body. The method is based on the assumption of a continuous distribution of sources and sinks over the body. The integral equation derived is solved by the method of successive approximations. The pressures at the wall and at the surface of an aircraft fuselage are calculated. V.P.

A80-21286 # **Hypersonic slipflow of a viscous gas over a slender delta wing (Obtekanie giperzvukovym potokom viazkogo gaza tonkogo treugol'nogo kryla so skol'zheniem).** G. N. Dudin. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 30-35. 7 refs. In Russian.

A numerical solution is obtained of the laminar boundary layer equations for a slender delta wing situated in a hypersonic viscous gas stream with a finite angle of sideslip. Global solutions of the three-dimensional boundary layer equations are also given. It is shown that in the presence of an angle of sideslip, local zones in which the boundary layer equations are not applicable do not appear and that a sufficiently smooth solution can be obtained over the entire wing surface. V.P.

A80-21287 # **Influence of an entropy layer on boundary layer separation in hypersonic flow (Vliianie entropiinogo sloia na otryv pogranichnogo sloia v giperzvukovom potoke).** V. Ia. Neiland and L. A. Sokolov. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 36-44. 8 refs. In Russian.

The analysis deals with the hypersonic flow of a viscous gas over a plate of finite length, parallel to the oncoming flow. It is assumed that a flap at the trailing edge of the plate is deflected through a small angle to the flow, and that an entropy layer (i.e., a region of inviscid flow in which the stagnation enthalpy is the same as in the hypersonic flow, while the stagnation pressure and density are much smaller than their values in the hypersonic flow) is situated between the boundary layer and the flow. The influence of the entropy layer on the flow is studied for flap deflection angles at which boundary layer separation just sets in. V.P.

A80-21293 # **Determination of the aerodynamic characteristics of a flight vehicle from onboard measurement data (Opredelenie aerodinamicheskikh kharakteristik letatel'nogo apparata po rezul'tatam bortovykh izmerenii).** A. V. Bobylev and M. P. Burmistrov. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 94-104. In Russian.

A data processing technique is proposed for determining the aerodynamic characteristics of a flight vehicle on the basis of data obtained by dropping a scale model of the flight vehicle from an aircraft. The technique is based on the use of Wenzel's (1958) method of canonical expansions and on the assumption that the motion of the scale model is purely plane and rotational, which makes it possible to cover the entire range of angles of attack. Qualitative and quantitative instrument error estimates are obtained. V.P.

A80-21294 # **Some parametric relations for designing large-aspect wings (Nekotorye parametricheskie zavisimosti dlia konstruktsii kryla bol'shogo udlineniia).** V. M. Frolov. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 105-112. In Russian.

The paper deals with the problem of designing a large-aspect wing when the planform geometry (i.e., the chord function, area, span, etc.) is known and the permissible stresses are determined from strength, stability, and service life considerations. The analysis is limited to the derivation of parametric relations which reveal the influence of the individual requirements or their combinations. V.P.

A80-21295 # **Flow over a plate in the presence of a vortex sink (Obtekanie plastinki v prisutstvii vikhrestoka).** Iu. A. Gorelov and G. A. Pavlovets. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 113-120. 5 refs. In Russian.

The present analysis deals with the flow of an ideal fluid over a wing with a sharp trailing edge in the presence of a 'vortex sink' formed by spanwise blowing over the trailing edge flaps and control surfaces. The solution obtained is seen to be useful for analyzing the characteristics of flows over lifting surfaces with spanwise blowing at their suction side. V.P.

A80-21296 # **Evaluation of the kernel of an integral equation for a wing performing harmonic oscillations in subsonic flow (O vychislenii iadra integral'nogo uravneniia dlia garmonicheski kolebliushchegosia kryla v dozvukovom potoke).** I. P. Gavva and V. V. Mozzhilkin. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 121-124. 8 refs. In Russian.

In the calculation of aerodynamic forces acting on a harmonically oscillating wing by the conventional dipole lattice method, the evaluation of a kernel having the form of a linear combination of improper integrals of rapidly fluctuating functions leads to substantial errors in the case of large Strouhal numbers. In the present paper, an improved procedure for evaluating such a kernel is proposed, using which the computer time is not increased. V.P.

A80-21298 # **Possibility of the onset of self-oscillations in cylindrical bodies situated in longitudinal liquid or gas flows in the case of crisis of drag (O vozmoznosti avtokolebanii tsilindricheskikh tel vdol' potoka zhidkosti ili gaza pri krizise soprotivleniia).** M. A. Gusev. *TsAGI, Uchenye Zapiski,* vol. 9, no. 3, 1979, p. 131-136. 9 refs. In Russian.

At flow velocities corresponding to the drag reduction at the critical Reynolds number (crisis of drag), there appears a descending branch on the static drag-to-flow velocity curve. In this case, negative aerodynamic damping may lead to excitation of self-oscillations in bodies in longitudinal flow. In the present paper, an attempt is made to provide a theoretical interpretation of this phenomenon and to develop a method of calculating the self-oscillations of cylindrical bodies. V.P.

A80-21301 # **Selecting the optimal geometrical twist of an aircraft wing (Vybor optimal'noi geometricheskoi krutki kryla samoleta).** V. A. Barinov. *TsAGI, Uchenye Zapiski,* vol. 9, no. 4, 1978, p. 1-8. 10 refs. In Russian.

A method is proposed for calculating the twist of swept-wing cross sections for a given wing planform and cross-section profiling. In view of the influence of twist on the load distribution over the chord and span of the wing, which in turn affects the weight and drag of the wing, it is suggested to determine the variation of the twist along the span on the basis of optimality criteria. Some possible optimality criteria are discussed, and their use in the method is demonstrated by examples. V.P.

A80-21302 # **Flow of a compressible fluid over an isolated airfoil and through a cascade (Obtekanie izolirovannogo profilia i reshetki profilei szhimaemoi zhidkost'iu).** B. I. Kurmanov and G. L. Podvidz. *TsAGI, Uchenye Zapiski,* vol. 9, no. 4, 1978, p. 9-16. 9 refs. In Russian.

The two-dimensional laminar attached flow of an inviscid incompressible fluid over an airfoil and through a cascade is analyzed. The flow is calculated, using density iterations, by the method of integral equations. For illustration, the method is applied to the calculation of the flow through a symmetric cascade. V.P.

A80-21303 # **Drag calculations for profiles at transonic speeds (K raschetu soprotivleniia profilei pri transzvukovykh skorostiakh).** Iu. G. El'kin. *TsAGI, Uchenye Zapiski,* vol. 9, no. 4, 1978, p. 17-23. 13 refs. In Russian.

In the present paper, flows over symmetric airfoil profiles are calculated for Mach numbers between 0.7 and 0.9 and Reynolds numbers of (1.0 to 4.2) x 10 to the seventh. The drag coefficients calculated from wake losses are found to be in satisfactory agreement with available experimental data. V.P.

A80-21310 # **The relationship between the critical reversal and divergence speeds for a straight wing (O sootnoshenii mezhdu kriticheskimi skorostiami reversa i divergentsii priamogo kryla).** A. P. Seiranian. *TsAGI, Uchenye Zapiski,* vol. 9, no. 4, 1978, p. 87-93. In Russian.

An integrodifferential equation describing the phenomenon of aileron reversal is derived for a straight wing. The equation is used to analyze the relationship between the critical reversal and divergence speeds as a function of the parameters of the problem. V.P.

A80-21313 # **The interaction of three shock waves (K zadache o vzaimodeistvii trekh udarnykh voln).** V. V. Podlubnyi. *TsAGI, Uchenye Zapiski,* vol. 9, no. 4, 1978, p. 102-106. In Russian.

Consideration is given to the interaction of three shock waves in the steady Mach configuration consisting of incident, reflected and Mach shock waves and a contact discontinuity intersecting at one point. The twelfth-order algebraic equation for the flow in the vicinity of the intersection point is reduced to a sixth-order algebraic equation describing the unsteady shock wave interaction, with a quadratic equation for the steady configuration and a cubic equation for the configuration with the reflected shock wave in the form of a normal shock. A numerical solution to the general equation for the pressure drop in the Mach wave front as a function of incident wave angle in a triple wave configuration is presented. A.L.W.

A80-21315 # **Centrifugal forces on a thin wing in hypersonic flight at large angles of attack (O tsentrobezhnykh silakh na tonkom kryle v giperzvukovom polete pri bol'shikh uglakh ataki).** V. N. Golubkin. *TsAGI, Uchenye Zapiski,* vol. 9, no. 4, 1978, p. 111-114. 8 refs. In Russian.

Perturbations to the hypersonic three dimensional flow around a thin wing with an attached shock at high angles of attack are analyzed, taking into account the effects of centrifugal forces due to the longitudinal curvature of the wing surface. A general solution to the problem of the hypersonic flow around a thin wing of arbitrary thickness distribution with an infinitely thin shock (Newtonian approximation) is employed to derive a simple expression for the pressure distribution around the wing. The shape of the shock is then obtained by the solution of a Cauchy problem with initial data on the leading edge. A.L.W.

A80-21317 # **Analytical investigation of the nonlinear characteristics of a small-aspect rectangular wing (Analiticheskoe issledovanie nelineinykh kharakteristik priamougol'nogo kryla malogo udlineniia).** V. F. Molchanov. *TsAGI, Uchenye Zapiski,* vol. 9, no. 5, 1978, p. 1-10. 5 refs. In Russian.

Nikolskii (1970) has derived an expression for the principal nonlinear term of the expansion for the lift coefficient of a rectangular wing. In the present paper, expressions for all the terms of the expansion of the lift and momentum coefficients are obtained. The expressions are extended to some special cases of unsteady flow. The results of the computations are examined. V.P.

A80-21319 # **Approximate method of determining the wave drag of a profile in the presence of a local supersonic region (Priblizhennyi metod opredeleniia volnovogo soprotivleniia profilia pri nalichii mestnoi sverkhzvukovoi zony).** V. D. Bokser and Ia. M. Serebriiskii. *TsAGI, Uchenye Zapiski,* vol. 9, no. 5, 1978, p. 21-29. 8 refs. In Russian.

An approximate method is proposed for calculating drag losses for transonic flows over wing profiles from the given pressure distribution over the wing. The method is based on wave drag theory and uses the linear nature of Mach number variation along a shock wave. A simple formula is derived for calculating the wave drag coefficient (separately for the upper and lower sides of the wing) from the given distribution of local Mach numbers over the wing surface. The wave drag coefficient is a function of the Mach number in front of the shock wave on the wing profile and also of the wing curvature at this point. V.P.

A80-21320 # **Calculation of the supersonic flow field with vortices behind a slender rectangular wing (Raschet polia sverkhzvukovogo techeniia s vikhriami za tonkim priamougol'nym krylom).** A. N. Minailos. *TsAGI, Uchenye Zapiski,* vol. 9, no. 5, 1978, p. 30-36. 8 refs. In Russian.

In the present paper, a difference scheme, in which an algorithm of the formation of Karman vortex streets is used as the boundary condition, is applied to the calculation of the near field behind a slender rectangular wing of an aspect ratio of 0.5, situated at an angle of attack of 15 degrees in a flow at a freestream Mach number of 5. The results are of interest to studies of the influence of the aircraft configuration on the sonic boom characteristics and of the influence of the field at the wing tip on the tail surfaces. V.P.

A80-21329 # **Weight minimization for a wing in the presence of constraints on the divergence speed (Minimizatsiia vesa kryla pri ogranichenii po skorosti divergentsii).** N. V. Banichuk. *TsAGI, Uchenye Zapiski,* vol. 9, no. 5, 1978, p. 97-103. 10 refs. In Russian.

In some earlier papers, mass minimization problems with constraints on the critical speed of torsional divergence were analyzed for rigidly fixed wings and constant wing span parameters (cord, cross sectional area), using the skin thickness over the wing span as the control function. In the present paper, the mass-minimization problem is extended to the case of an elastically fixed wing and variable wing parameters. An analytical solution of the problem is used to study the influence of elastic fixing and variable wing cross section on the optimal stiffness distribution over the wing span. V.P.

A80-21332 # **Calculation of the coefficient of secondary losses in an axial compressor stage (Raschet koeffitsienta vtorichnykh poter' v stupeni osevogo kompressora).** A. S. Novikov and F. Ia. Shebakpol'skii. *TsAGI, Uchenye Zapiski,* vol. 9, no. 5, 1978, p. 116-119. In Russian.

A80-21335 # **Approximate estimation of the least number and optimal distribution of landing airports for maneuvering hypersonic flight vehicles (Priblizhennaia otsenka minimal'nogo kolichestva i optimal'nogo raspolozheniia aerodromov dlia posadki manevriruiushchikh giperzvukovykh letatel'nykh apparatov).** A. S. Filat'ev. *TsAGI, Uchenye Zapiski,* vol. 9, no. 5, 1978, p. 129-132. In Russian.

It is required to determine the least required number of hypersonic landing airports and their optimal distribution, in the case where the initial values of the hypersonic flight path parameters belong to a certain manifold, and are completely defined by a single parameter, say the initial velocity. In the present paper, the optimality conditions are obtained and are used to develop a simple geometrical method of constructing optimal airport networks as a function of the threshold maneuverability of the flight vehicles. V.P.

A80-21341 # **Delta wing of optimal configuration in supersonic flow (Treugol'noe krylo optimal'noi formy v sverkhzvukovom potoke).** V. S. Nikolaev. *TsAGI, Uchenye Zapiski,* vol. 9, no. 6, 1978, p. 38-47. In Russian.

A80-21342 # **Calculation of the supersonic flow past a winged bielliptical body (Raschet sverkhzvukovogo obtekaniia biellipticheskogo tela s kryl'iami).** V. P. Galinskii and V. I. Timoshenko. *TsAGI, Uchenye Zapiski,* vol. 9, no. 6, 1978, p. 48-55. 13 refs. In Russian.

In the present paper, a method proposed by MacCormack (1969) is applied to the calculation of the supersonic flow of an inviscid nonheat-conducting gas past a three-dimensional body of the delta-wing type with blunted leading edges. Numerical results obtained for a freestream Mach number of 6 and angles of attack ranging from 0 to 10 degrees are analyzed. V.P.

A80-21343 # **Calculation of some aerodynamic characteristics of a flexible aircraft by an influence coefficient method (Raschet nekotorykh aerodinamicheskikh kharakteristik uprugogo samoleta metodom koeffitsientov vliianiia).** D. D. Evseev. *TsAGI, Uchenye Zapiski,* vol. 9, no. 6, 1978, p. 56-66. 7 refs. In Russian.

The algorithm and block diagram of a ZMKB program developed in FORTRAN for the BESM-6 computer are discussed. The calculated aerodynamic characteristics (such as the longitudinal stability derivatives) of a large transport aircraft performing a prescribed maneuver are examined and are compared with the experimentally established characteristics. A method of determining the assembly jig configuration for a flexible aircraft from the shape of its surface in cruising flight is proposed. V.P.

A80-21349 # **Influence of the leading-edge planform on the hypersonic flow over a small-aspect-ratio wing (Vliianie formy perednei kromki v plane na giperzvukovoe obtekanie kryla malogo udlineniia).** V. N. Golubkin. *TsAGI, Uchenye Zapiski,* vol. 9, no. 6, 1978, p. 115-121. 10 refs. In Russian.

The hypersonic flow over the pressure side of a small-aspect-ratio wing at an angle of attack is analyzed within the framework of shock-layer theory. Expressions for the gasdynamic functions are derived, along with an equation for shape of the compression shock in the case of a slightly perturbed three-dimensional flow over a slender wing closely approaching a delta wing. The shape of the compression shock and the pressure distribution over the wing surface near the junction point of two straight portions (of different sweepback) of the leading edge are studied. The application of the formulas derived is illustrated by an example. V.P.

A80-21429 # **Design of a wind shear detection radar for airports.** R. B. Chadwick, K. P. Moran, and W. C. Campbell (NOAA, Wave Propagation Laboratory, Boulder, Colo.). *IEEE Transactions on Geoscience Electronics,* vol. GE-17, Oct. 1979, p. 137-142. 18 refs. AF Order Y77-847; AF Project ESD-9-0864.

Designing a radar to detect hazardous wind shear is treated in two steps. First, a field experiment was conducted to determine the strength of the return signal, and statistical results from this experiment are given. Second, these results are used in design of a clear-air radar for shear detection. The tradeoff between wavelength, transmitted power, and antenna size is shown. A simple display technique using a plan shear indicator is also described. (Author)

A80-21460 * **Circumpolar measurements of ozone, particles, and carbon monoxide from a commercial airliner.** R. Pratt and P. Falconer (New York, State University, Albany, N.Y.). *Journal of Geophysical Research,* vol. 84, Dec. 20, 1979, p. 7876-7882. 21 refs. Grant No. NsG-3138.

Trace constituent data are presented from the unique flight of an airliner around the world over both poles. Relatively high resolution and simultaneous measurements of ozone, carbon monoxide, light-scattering particles, condensation nuclei, and meteorological parameters were obtained. The mutual variations of the data in the polar stratospheres, and in the tropical upper troposphere, are discussed in their meteorological setting. The data from the Arctic lower stratosphere are consistent with a tropospheric source of condensation nuclei, but not of carbon monoxide. Carbon monoxide mixing ratios in the Antarctic stratosphere averaged 44 ppbv. In the tropical troposphere they averaged 66 ppbv over the Pacific versus 89 ppbv over Africa. A local area of higher concentration (115 ppbv) was encountered over tropical Africa; its possible relation to carbon monoxide production by vegetation and deep convection is discussed. Evidence was found in the tropical upper troposphere of distinct boundaries between air masses of different temperature, ozone content, and particle content. (Author)

A80-21630 **Sub-cloud eddy fluxes and scales of vertical motion in a cumulus environment.** R. F. Reinking (NOAA, Weather Modification Program Office, Boulder, Colo.). In: Conference on Cloud Physics and Atmospheric Electricity, Issaquah, Wash., July 31-August 4, 1978, Preprints. Boston, Mass., American Meteorological Society, 1978, p. 402-407. 12 refs.

The paper discusses scales and intensities of boundary layer mixing and associated eddy fluxes of moisture and sensible heat measured near Chickasha, Oklahoma during a three-day springtime period of increasing moistening of the boundary layer and consequent diurnal cumulus development. The measurements made with an airborne gust-probe system are compared with the data obtained by means of a dual-Doppler radar. The three-day transition from clear skies to significant diurnal cumulus cloudiness is examined for characteristics of the fluxes and the mixing process in the clear air and below the bases of the cumuli. V.T.

A80-21676 # **The process of chemical milling in machining aircraft structures (Il processo di fresatura chimica nella lavorazione delle strutture aeronautiche).** G. Romeo (Torino, Politecnico, Turin, Italy). *Ingegneria,* Nov.-Dec. 1979, p. 321-334. 13 refs. In Italian.

The fundamental principles of chemical milling of aluminum alloys for aircraft are described, including polishing, masking, notching of the masking, and metal corrosion. The toxic effects of various amounts of chemicals on the human organism are discussed, including that of chemicals such as sulfuric acid and nitric acid. The influence of chemical etching (with and without a vapor blast) on static strength as well as on fatigue resistance is also considered. In addition, metal corrosion is discussed in the light of the four procedures that can be used to effect the milling of the structure: uniformly over the whole surface, partially over preselected areas, stepwise, and with linear tapering. Methods of masking, by immersion, by flow, by spray, and photographically, are presented, as are applications of the process. J.P.B.

A80-21750 **Fault-surviving flight control avionics.** L. J. Franchi (Bendix Corp., Southfield, Mich.). *Military Electronics/ Countermeasures,* vol. 5, Dec. 1979, p. 40, 42, 44 (3ff.).

Fly-by-wire (FBW) and related control systems, apart from saving space and weight through elimination of heavy mechanical control elements, can improve aircraft performance, reliability and safety. The feasibility of redundant analog and digital quadruplexed FBW for fighter aircraft has been confirmed by a number of programs sponsored by NASA and aircraft manufacturers. While the FBW payoffs are greatest in modern fighter aircraft, where performance limits are important, the FBW and related systems are also being adopted in civil aircraft for direct force control, RSS, dynamic load alleviation, flutter suppression, ride qualities improvement and energy conservation. Some future programs based on the FBW concept include Control Configured Vehicles (CCV), Advanced Fighter Technology Integration (AFTI) and Fly-By-Light (FBL). V.L.

A80-21876 **A practical guide to airplane performance and design.** D. R. Crawford (TRW, Inc., Redondo Beach, Calif.). Torrance, Calif., Crawford Aviation, 1979. 222 p. 38 refs. $15.95.

The work presents a method which enables the rapid prediction of aircraft performance by means of graphical techniques. Detailed sample calculations, techniques for parametric studies using a template supplied, and the full theoretical background are given. In addition, a performance rating parameter is defined and tabulated for comparison of numerous propeller-driven homebuilt, factory, and military aircraft. A computer program is also included as an alternative method of performing the analysis of airplane performance. M.E.P.

A80-21887 **A multiple transfer function model for air traffic control systems.** N. W. Polhemus (Princeton University, Princeton, N.J.). *Transportation Research, Part B: Methodological,* vol. 13B, Sept. 1979, p. 229-236. 6 refs. U.S. Department of Transportation Contract No. FA72NA-741.

This paper considers the problem of modeling dynamic fluctuations in aircraft concentration within a group of air traffic control sectors. Using simultaneous time series recorded for each of the sectors, a multiple transfer function noise model is constructed. The modeling procedure demonstrates a data-dependent approach to ATC systems analysis which does not rely on describing the movement of individual aircraft. (Author)

A80-21897 **Advanced flight controls for transport aircraft.** W. J. Hargrove (Lockheed-Georgia Co., Marietta, Ga.). *Lockheed Horizons,* Winter 1979-1980, p. 38-45.

Some advanced flight control concepts and techniques to be applied to future transport aircraft for fuel conservation, enhanced operations and reduced costs are summarized. Included are fault-tolerant digital controls, active controls with functions such as augmented stability, structural wing maneuver, gust load alleviation, ride control, flutter or other dynamic elastic mode control and structural fatigue reduction. The Fly-By-Wire/Fly-By-Light techniques, (utilizing electric paths or fiber optic light signal transmission respectively), and such unconventional controllers as direct lift control, direct side force control and direct drag control are detailed. Also discussed are electronic displays for enhanced pilot controllability, and controls used in terminal operations, such as 4-dimensional flight path control and automatic landing. L.M.

A80-21923 **Composites in aircraft manufacturing - An impressive rise (Les composites chez les avionneurs - Une montée impressionnante).** J. Morisset and G. Collin. *Air et Cosmos,* vol. 17, Dec. 8, 1979, p. 23-25, 27. In French.

The use of composite materials by Western European aircraft manufacturers is reviewed. Work performed at Dassault has included studies of the relative advantages of high-strength carbon and boron fibers, leading to the use of boron fiber composites for the horizontal empannage of the Mirage F 1, carbon fiber composites for its ailerons, and carbon-fiber-coated honeycomb structures for the Falcon 50 ailerons. The Mirage 2000 and 4000 employ composites extensively in their primary and secondary structures, including the fuselage doors, elevator ailerons, vertical stabilizer and rudder. A carbon fiber wing surface is being developed for the Falcon 10 jointly by Dassault and Aérospatiale, while the A300 carries two to three tonnes of glass fiber components. Sandwich-structure Karman fairings, landing-gear hatches, and elevator ailerons have been developed for the Concorde, and carbon fiber airbrakes for the A310 and composite support rods are also under development. A.L.W.

A80-21935 **Systems analysis for planning of air fleets and maintenance facilities.** V. V. S. Sarma, A. K. Rao (Indian Institute of Science, Bangalore, India), and K. Ramchand (Central Servicing Development Organization, Kanpur, India). *Indian Academy of Sciences, Proceedings, Section C: Engineering Sciences,* vol. C 2, May 1979, p. 243-261. 24 refs.

The paper presents a study aimed at developing simulation and systems analysis techniques for the effective planning and efficient operation of small fleets of aircraft, typical of the airforce of a developing country. Consideration is given to an important aspect of fleet management: the problem of resource allocation for achieving prescribed operational effectiveness of the fleet. Attention is given to the steady state availability which is computed under the assumptions of Poisson arrivals, exponential service times and an equivalent single server repair-depot. This analysis also brings out the effect of fleet size on availability. Finally, a simulation model of the system has been developed using GPSS to study sensitivity to distributional assumptions, to validate the principal assumptions of the analytical model such as the single-server assumption and to obtain confidence intervals for the statistical parameters of interest. M.E.P.

A80-21961 **The case of subsonic jet aircraft (Le cas des avions subsoniques à réaction).** J.-P. Troadec (Direction Générale de l'Aviation Civile, Direction des Programmes Aéronautiques Civils, Paris, France). *Voies-Aviation Civile,* Fall-Winter 1979, p. 16-18. In French.

The problem of aircraft noise near airports is discussed. Attention is given to the technical aspects of the problem and to noise norms and regulations. Noise reduction techniques associated with the development of the Airbus and the CFM 56 engine are examined. B.J.

A80-21962 **Research (La recherche).** M. Pianko (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *Voies-Aviation Civile,* Fall-Winter 1979, p. 31-34. In French.

Work being done in France concerning the reduction of aircraft noise is briefly reviewed. Attention is given to noise sources, supersonic and subsonic aircraft noise, and testing efforts at SNECMA, ONERA, and CEPRA. Future prospects of French noise reduction efforts are briefly examined. B.J.

A80-21965 # **Navigation systems for modern aircraft (Sistemi di navigazione adottati sui velivoli moderni).** A. Strumia. *Istituto Italiano di Navigazione, Atti,* Jan.-June 1979, p. 5-13. 10 refs. In Italian.

Three fundamental types of air navigational systems are considered: instrumental (inertial and noninertial), radio, and hybrid. Particular emphasis is given to (self-contained) inertial instrumentation, including a 4-Cardan stabilized platform, and the strapdown system. Noninertial systems including the Doppler radar and altitude heading reference systems are discussed, as well as laser and electrostatic types of gyroscopes. Attention is given to the use of

computers and the corresponding software, and to the increasing importance of microprocessors. Radio systems such as the Omega/VLF and Navstar GPS, and hybrid systems using the Kalman filter are considered, as are future trends in navigational displays including the head-up display and color television screens. J.P.B.

A80-21966 # **Air traffic control - Italian prospects (Il controllo del traffico aereo - Prospettive in Italia).** L. Bartolucci (Stato Maggiore dell'Aeronautica, Rome, Italy). *Istituto Italiano di Navigazione, Atti,* Jan.-June 1979, p. 15-29. In Italian.

The present situation and the next decade's prospects for the Italian system of flight-assisting services, including telecommunications and meteorology, are outlined. Future technological developments, increased international collaboration, and semi-automation of air traffic control are considered, as well as a restructuring of air space coverage. Particular attention is given to the increased development and maximum extension of radar control in Italy. J.P.B.

A80-21967 # **The evolution of air traffic control systems - The present situation and future tendencies (L'evoluzione nei sistemi del controllo del traffico aereo - Situazione attuale e tendenze future).** G. Barale (Selenia S.p.A., Divisione Radar e Sistemi Civili, Rome, Italy). *Istituto Italiano di Navigazione, Atti,* Jan.-June 1979, p. 47-67. In Italian.

The technical aspects of automating air traffic control (ATC) are discussed, encompassing telecommunications, meteorology, and the reliability of hardware and software. Present technology is considered, including operational automated systems in the U.S. and England, as well as the Eurocontrol agency. The principal requisites of a medium-sized system of ATC are outlined: the functions to be automated, system modularity, expandability, maintenance, and adaptability to future technology. In addition, the ATCAS system (a third generation automated system), which is designed to integrate multiple radar systems for coverage of the Italian peninsula is described, with subsystems including radar, communication, and data handling. J.P.B.

A80-21970 # **Human factors in aircraft accidents.** R. H. Shannon and R. A. Alkov. *Approach,* vol. 25, Dec. 1979, p. 18-21.

The main purpose of the work is to examine the human errors that are involved in aircraft accidents, emphasizing pilots and other personnel as the primary accident causes. Some of the physiological, psychological and psychosocial limitations and strengths of human beings are examined. It is concluded that the realization of our human error rates may not significantly improve while the cost per mishap will consistently increase and that a more innovative program will be necessary for future improvements. C.F.W.

A80-21980 # **Wind tunnel design and performance for rough wall turbulent boundary layer.** Y. Kageyama, H. Osaka, H. Yamada, and T. Hirano. *Yamaguchi University, Faculty of Engineering, Memoirs,* vol. 30, Oct. 1979, p. 147-155. 8 refs. In Japanese, with abstract in English.

A new wind tunnel for rough wall turbulent boundary layer researches was designed and examined. The design or choice of the contraction, diffuser, honeycombs and screens is described in detail because of the strong influence of these components on tunnel performance. Measurements of mean velocity, wall shear stress, turbulence intensity and Reynolds stress are also described. From the experimental results, it may be concluded that this tunnel has an extensive usefulness for experimental researches for rough wall turbulent boundary layers. (Author)

A80-22046 **Short haul transport for the 1990s.** P. Robinson (British Aerospace, Aircraft Group, Kingston-upon-Thames, Surrey, England) and D. G. Brown (British Aerospace, Aircraft Group, Hatfield, Herts., England). *Aeronautical Journal,* vol. 83, Nov. 1979, p. 413-436. 23 refs.

The paper presents an analysis of market trends and technical developments in short haul air transport over the next 20 years. Regional estimates of the market are given in accordance with the ICAO breakdown for 1990 and 2000 in revenue passenger kilometers, average annual growth rates, and aircraft units. Restraints and stimuli controlling the short haul market are analyzed, e.g. economic factors, safety, communications, and ecological considerations. Technological advances will be of evolutionary, rather than revolutionary, nature. In propulsion, emphasis will be on improving specific weight, reducing complexity and cost, and increasing reliability and safety. Advances in aerodynamics will include reduction of subcritical drag and application of wing tip devices to improve lift drag ratio under low speed and cruise conditions. While aircraft configurations will remain essentially the same, substantial benefits in fuel economics and overall performance will be derived from improved materials, systems and equipment. V.L.

A80-22103 # **The effect of equatorial ionospheric disturbance on aircraft-to-satellite communications.** A. L. Johnson (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio). In: Symposium on Beacon Satellite Measurements of Plasmaspheric and Ionospheric Properties, Florence, Italy, May 22-25, 1978, Proceedings. Florence, Italy, Consiglio Nazionale delle Ricerche, 1978, p. 33-1 to 33-7.

The effect of natural ionospheric scintillation on UHF satellite communications to an aircraft is evaluated in a series of equatorial flights. The results indicate that the range of fading, which a system designer will have to consider for an airborne system, is extended on both the high and low fade rates from the normal ground fade rate data. V.T.

A80-22146 # **Looking ahead.** T. Ford. *Aircraft Engineering,* vol. 52, Jan. 1980, p. 2-5.

An attempt is made to predict trends in aircraft design on the basis of a survey of recognized present-day practices and advanced technology. A discussion of the influence of various factors on commercial air transportation is followed by an analysis of the potential for both modified and new aircraft in the overall system. V.P.

A80-22147 # **Aircraft noise assessment.** *Aircraft Engineering,* vol. 52, Jan. 1980, p. 6-9.

The present paper deals with the British noise exposure index, known as NNI, or Noise and Number Index, which has gained wide acceptance for description and assessment of flight operational noise in the vicinity of airports. The NNI calculation takes account of the take-off noise exposure from start-of-roll to the initial climb stage, and of the established approach to landing operation. V.P.

A80-22148 * # **Research developments for aircraft safety.** K. E. Hodge (NASA, Washington, D.C.). *Aircraft Engineering,* vol. 52, Jan. 1980, p. 10-15.

The paper deals with an aviation safety technology program, whose objective is to provide technology for near-term application to civil transport aircraft and for designing the next generation of advanced transports. The influence of research and development efforts on current safety levels and aircraft operating efficiency is examined. V.P.

A80-22253 **Royal Society, Discussion on New Fibres and Their Composites, London, England, May 18, 19, 1978, Proceedings.** *Royal Society (London), Philosophical Transactions, Series A,* vol. 294, no. 1411, Jan. 21, 1980. 191 p.

Papers are presented on such topics as the FP alumina fiber, the development of silicon carbide fibers from organosilicon polymers, carbon fibers from mesophase pitch, fibers from extended chain

aromatic polyamides, and factors affecting the strength of carbon fibers. Also described are: fatigue processes in fiber-reinforced composites, metal matrix composites reinforced with FP alumina fiber, interfaces in composite materials, and the contribution of resin matrices to composite properties. B.J.

A80-22262 **Resin matrices and their contribution to composite properties.** J. W. Johnson (Rolls-Royce, Ltd., Plastics and Composite Materials Laboratory, Derby, England). *(Royal Society, Discussion on New Fibres and Their Composites, London, England, May 18, 19, 1978.) Royal Society (London), Philosophical Transactions, Series A,* vol. 294, no. 1411, Jan. 21, 1980, p. 487-494.

The relation between matrix and composite properties for glass and carbon fiber reinforced plastics is discussed from a number of viewpoints. Examples of material requirements for specific component applications are discussed; attention is given to such problems in composite manufacture as voids, water absorption, compression failure, and matrix strength. A matrix, based on a mixed epoxy/polysulphone adhesive, that realizes the above requirements and is suitable for use in aerospace structures is discussed. B.J.

A80-22270 **Principles of design of a carbon fibre composite aircraft wing.** I. C. Taig (British Aerospace, Aircraft Group, Preston, Lancs., England). *(Royal Society, Discussion on New Fibres and Their Composites, London, England, May 18, 19, 1978.) Royal Society (London), Philosophical Transactions, Series A,* vol. 294, no. 1411, Jan. 21, 1980, p. 565-575. Research sponsored by the British Aerospace.

The two basic decisions in designing a carbon fiber composite wing are the selection of materials and the form of construction to be employed. The paper outlines the program objectives, the design requirements and the constraints imposed thereby, and then presents in some detail the principles used to arrive at these decisions. The materials choice is a compromise between technical, manufacturing, commercial and strategic factors. The form of construction is chosen to obtain substantial weight saving at acceptable manufacturing cost, paying particular attention to four technical factors which are found to dominate the design. These are: (1) design for integrity in the presence of built-in and accidentally induced stress raisers; (2) design for structural stability; (3) design for integrity in a service environment including the effects of humidity and elevated temperature exposure; and (4) design and test margins to give adequate allowance for anticipated variability of structural performance. (Author)

A80-22271 **Design and engineering of carbon brakes.** I. L. Stimson and R. Fisher (Dunlop, Ltd., Aviation Div., Coventry, England). *(Royal Society, Discussion on New Fibres and Their Composites, London, England, May 18, 19, 1978.) Royal Society (London), Philosophical Transactions, Series A,* vol. 294, no. 1411, Jan. 21, 1980, p. 583-590.

The paper examines the various factors which must be considered to provide adequate structural, thermal and friction characteristics for carbon brake disks, noting that such disks offer a 60% weight saving compared with steel. It is shown that the design of the composite is particular to the application, and that orientation of the fibers on account of stress and heat flow requirements is vital to the achievement of a successful design. Attention is given to the manufacturing method for the composite of the Concorde brakes which consists of chemical vapor deposition of carbon into a carbon fiber layup. Finally, the role of material property evaluation and quality control practice is discussed. M.E.P.

A80-22578 # **Synthesis of an adaptive flight control system with an observer.** K. Kanal, T. Degawa, and T. Noguchi (Defense Academy, Yokosuka, Japan). *Japan Society for Aeronautical and Space Sciences, Transactions,* vol. 22, Nov. 1979, p. 139-151. 5 refs.

The paper proposes an adaptive scheme and a computation method for estimating parameters and state variables which can reduce the errors and computations in estimating the VTOL aircraft dynamic characteristics. A computational algorithm is proposed. which combines the advantages of two different adaptive observer schemes which improve the convergence characteristics; an adaptive controller is designed to generate a control input by a differentiator-free controller so that the output of the plant evolves asymptotically towards that of a given model. A numerical computation shows that the convergence rate of the identification is improved, and the desired response can be quickly obtained; simulation studies for designing the VTOL aircraft flight controller are presented to demonstrate its effectiveness. A.T.

A80-22687 * **Durability of foam insulation for LH2 fuel tanks of future subsonic transports.** E. L. Sharpe (NASA, Langley Research Center, Hampton, Va.) and R. G. Helenbrook (Bell Aerospace Textron, Buffalo, N.Y.). In: Nonmetallic materials and composites at low temperatures; Proceedings of the Conference, Munich, West Germany, July 10, 11, 1978. New York, Plenum Press, 1979, p. 207-230. 6 refs.

Organic foams were tested to determine their suitability for insulating liquid hydrogen tanks of subsonic aircraft. The specimens, including nonreinforced foams and foams with chopped glass reinforcements, flame retardants, and vapor barriers, were scaled to simulate stress conditions in large tanks. The tests were conducted within aluminum tank compartments filled with liquid hydrogen and the boil-off rate was used as the criterion of thermal performance. It was found that while all insulations deteriorated with increased cycles, two nonreinforced polyurethane foams showed no structural deterioration after 4200 thermal cycles (equivalent to 15 years of airline service). It was also found that fiberglass reinforcement and flame retardants impaired thermal performance and reduced useful life of the foams. Vapor barriers enhanced structural integrity without any deterioration in thermal properties. V.L.

A80-22723 # **Reliability problems in avionics (Problemy niezawodnosci w awionice).** S. Tujaka (Przemyslowy Instytut Telekomunikacji, Warsaw, Poland). *Technika Lotnicza i Astronautyczna,* vol. 34, Dec. 1979, p. 7-10. In Polish.

The impact of electronics on aviation is reviewed, along with the major requirements placed on avionics. Methods of ensuring and improving the reliability of aircraft electronic systems are examined. The application of a mathematical model in the form of a stochastic Poisson process to the derivation of an expression for the probability of failure over a given period of time is demonstrated. V.P.

A80-22724 # **Application of the discrete-phase method /DPM/ to the investigation and monitoring of aircraft turbine engine blade vibrations. II (Zastosowanie metody dyskretno-fazowej /MDF/ do badan i kontroli drgan lopatek lotniczych silnikow turbinowych. II).** R. Laczkowski (Gdansk, Politechnika, Gdansk, Poland). *Technika Lotnicza i Astronautyczna,* vol. 34, Dec. 1979, p. 10-12. In Polish.

Part I dealt with the ELIA-2 device and its application to the determination of dynamic stresses in spinning blades by measuring the amplitudes of blade tip vibrations. In the present paper, the electromagnetic and capacitance sensors employed in this device are discussed, and a method for calibrating the ELIA-2 device is proposed. The application of the discrete-phase method to the determination of blade resonance vibrations, blade flutter, and blade buffeting is described. V.P.

A80-22725 # **Organization of regional airports (Organizacja regionalnych portow lotniczych).** J. Czownicki and Z. Hyla. *Technika Lotnicza i Astronautyczna,* vol. 34, Dec. 1979, p. 22-24. In Polish.

The paper deals with the principles of planning, designing, and constructing regional airports for efficient cost-effective operation.

Attention is given to the specific aspects of regional administration, service, aircraft maintenance, etc. A functional diagram of a regional airport is discussed. V.P.

A80-22727 * # **An experimental and numerical investigation of a three-dimensional shock wave separated turbulent boundary layer.** M. I. Kussoy, J. R. Viegas, and C. C. Horstman (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0002.* 21 p. 32 refs.

A detailed investigation of a flow in which a three-dimensional shock wave separates a two-dimensional turbulent boundary layer is presented. The resulting flow field is highly three-dimensional with a significant portion of flow separation on the surface at the 0 deg azimuthal coordinate (windward) plane as well as a large zone of secondary surface flow off this plane. Mean and fluctuating experimental measurements were obtained throughout the entire flow field. These measurements included mean pressures, flow angles and shear on the surface, as well as yaw angles, static pressures, turbulent shear stresses and turbulent kinetic energies on selected planes throughout the flow field. In addition, numerical predictions of this flow, obtained by solving the Navier-Stokes equations with an algebraic eddy viscosity turbulence model, are presented. These computations can reasonably predict both the surface and flow-field quantities, despite the extremely complicated nature of the experimental flow. (Author)

A80-22729 * # **Noise generation by a lifting wing/flap combination at Reynolds numbers to 2.8 x 10 to the 6th.** J. M. Kendall (California Institute of Technology, Jet Propulsion Laboratory, Molecular Physics and Chemistry Section, Pasadena, Calif.) and W. F. Ahtye (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0035.* 12 p. 12 refs. NASA-supported research.

Measurements relating to the noise source location and intensity within various frequency bands were made for an 0.75 m-chord wing/flap model installed in the Ames 7 x 10-foot wind tunnel. A directional microphone system, located outside the open-wall tunnel was scanned in a two-dimensional array of aiming points about the positive-pressure side of the model to determine the principal locations of noise production, and the intensity of each of these. It was found for the case of the flaps being differentially deflected (0 deg, 35 deg) at the half-span station that noise production was concentrated in the immediate region of the resultant surface discontinuity. For equal deflection of the halves (0 deg, 0 deg or 35 deg, 35 deg), noise was produced uniformly along the length of the gap between the wing and the flap. Simulated flap-mounting brackets generated considerable noise in certain cases, but reduced the noise in others. Trailing edge noise did not appear to be important in comparison with other sources. (Author)

A80-22733 * # **Propeller slipstream/wing interaction in the transonic regime.** M. H. Rizk (Flow Research Co., Kent, Wash.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0125.* 9 p. 11 refs. Contract No. NAS2-9913.

An inviscid model for the interaction between a thin wing and a nearly uniform propeller slipstream is presented. The model allows the perturbation velocities due to the interaction to be potential although the undisturbed slipstream velocity is rotational. A finite difference scheme is used to solve the governing equation. Numerical examples indicate that the slipstream has a strong effect on the aerodynamic properties of the wing section within the slipstream and lesser effects elsewhere. The slipstream swirling motion strongly affects the wing load distribution, however, its effect on the wing's total lift and wave drag is small. The axial velocity increment in the slipstream has a small effect on the wing lift, however, it causes a large increase in wave drag. (Author)

A80-22740 # **The innovative application of boost engine technology to the design of a variety of tactical and strategic aircraft.** R. C. Sutton and P. G. Osterbeck (Boeing Military Airplane Co., Seattle, Wash.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0190.* 9 p. 5 refs.

The paper discusses the problem of optimum propulsion system match for aircraft designed to multiple requirements. Emphasis is placed on the inovative use of boost engine technology to achieve minimum airplane size and cost. Examples have been shown where mixed propulsion (boost engine plus cruise engine) integration in initial design is a high leverage tool when considered for specific applications: tactical ground attack, dual-mission bomber, and high speed penetrator. The paper extends the previous work to encompass several new applications peculiar to current operational requirements: V/STOL, manned penetrating bomber, tactical airlift, energy efficient airlift, and supercruise STOL. An overview of the design trades for each of these types is given. (Author)

A80-22748 # **A cooled laminated radial turbine technology demonstration.** R. W. Vershure, Jr., G. D. Large, L. J. Meyer (AiResearch Manufacturing Company of Arizona, Phoenix, Ariz.), and J. M. Lane (U.S. Army, Applied Technology Laboratory, Fort Eustis, Va.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0300.* 12 p. 24 refs. Grant No. DAAJ02-77-C0032.

A low-cost, high-temperature radial turbine has been developed that demonstrates the technology required to manufacture a small, cooled turbine using photoetched laminates bonded together to form a complete wheel. An advanced long-life and high-performance turbine design is described which uses an iterative optimization procedure to provide a balanced mechanical and aerodynamic design. The calculated bulk heat-transfer effectiveness was 0.54 with operation at 2300 F over a typical Army helicopter mission of 6000 cycles and with a design life of 5000 hours. Several wheels were manufactured from Astroloy, and the mechanical integrity was demonstrated in a series of proof tests conducted in a whirlpit test facility. (Author)

A80-22749 # **High temperature radial turbine demonstration.** B. A. Ewing, D. S. Monson (General Motors Corp., Detroit Diesel Allison Div., Indianapolis, Ind.), and J. M. Lane (U.S. Army, Applied Technology Laboratory, Fort Eustis, Va.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0301.* 13 p.

This paper describes and presents the results of the design, process development, and mechanical verification program for a high temperature radial turbine. The turbine is designed to meet the Army requirements for a reliable, high performance, low cost turbine for future fixed and rotary winged aircraft. The resulting design was a dual property air cooled rotor using a cast Mar-M247 airfoil shell and a PA101 powdered metal disk. These components were diffusion bonded using the hot isostatic pressure (HIP) process. Material property evaluations and mechanical integrity component tests are discussed. (Author)

A80-22751 * # **Transonic swept-wing analysis using asymptotic and other numerical methods.** H. K. Cheng, S. Y. Meng (Southern California, University, Los Angeles, Calif.), R. Chow (Grumman Aerospace Corp., Bethpage, N.Y.), and R. C. Smith (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0342.* 24 p. 62 refs. Contract No. N00014-75-C-0520; Grant No. NCA2-OR730-601.

The paper presents asymptotic methods for high-aspect-ratio wings in transonic flow developed for straight unyawed wings and for oblique wings. They show that the three-dimensional mixed-flow

calculations may be reduced to solving a set of two-dimensional problems at each span station; the development of this theory and the related computational studies are reviewed. Differences between the piloted (oblique) wing, the swept-back wing, and the swept-forward-wing in the induced upwash are discussed; examples of similarity solutions are demonstrated for high subcritical and slightly supercritical component flows, and comparisons made with re-laxation solutions of a full potential equation. The examples include oblique and symmetric swept wings, and the adequacy of the existing full-potential computer code is examined. A.T.

A80-22763 **Bell tilt-rotor - The next V/STOL.** M. Lambert. *Flight International,* vol. 117, Feb. 9, 1980, p. 381-386, 412.

The article surveys the design and features of the Bell XV-15 tilt-rotor V/STOL. Attention is given to the advantages of this design which include cruising at moderate speeds with reasonable economy, as well as hovering without causing intense vortices or surface heating or using prohibitive quantities of fuel. It is noted that the manufacturer views the tilt-rotor as the next step in helicopter performance and economy. M.E.P.

A80-22839 # **History of Soviet aircraft design to 1938: Notes toward a history of aircraft production /2nd revised and enlarged edition/ (Istoriia konstruktsii samoletov v SSSR do 1938 g.: Materialy k istorii samoletostroeniia /2nd revised and enlarged edition/).** V. B. Shavrov. Moscow, Izdatel'stvo Mashinostroenie, 1978. 576 p. 65 refs. In Russian.

The book presents a historical review of Soviet aircraft from the beginning of aviation in Russia to 1938, including their design and development. Approximately 800 production, prototype, and experi-mental aircraft are included, and their dimensions, weight, design, and flight characteristics are described. The development of aircraft technology is aerodynamics, strength of materials, engines, pro-pellers, armaments, and equipment is discussed in relation to various aircraft. A.T.

A80-22914 # **Airfoil with minimum relaxation drag.** H. Buggisch, W. Ellermeier, and J. Wellmann (Darmstadt, Technische Hochschule, Darmstadt, West Germany). *Archiwum Mechaniki Stosowanej,* vol. 31, no. 3, 1979, p. 339-351. 9 refs.

The following problem is discussed: what is the shape of a two-dimensional airfoil which, at a given length, area and lift, makes the relaxation drag (i.e., the drag caused by thermodynamic relaxation) a minimum. The discussion is confined to the cases of subsonic flows and slender airfoils. The optimal shape is actually derived for the case of near equilibrium flow. Thus the problem is reduced to minimizing a certain integral under the side condition that the length, area and lift of the airfoil have prescribed values. (Author)

A80-22983 **Research programs in general aviation - Next generation aircraft.** M. Grangier. *Interavia,* vol. 35, Feb. 1980, p. 123-128.

Research programs by private industry and by NASA on economy, performance, safety, pollution reduction, and reliability of light aircraft are outlined, with emphasis on engine and propeller designs, aerodynamics, and avionics. In particular, diesel engines, re-positioned propellers, as well as those with bent tips and those made of lighter composite materials, and winglets developed by NASA are expected to effect improvements in aircraft, as well as microprocessors and the new GAW2 laminar flow aerofoil. J.P.B.

A80-22984 **The Mitsubishi Diamond I - What are its chances on the current market.** M. Grangier. *Interavia,* vol. 35, Feb. 1980, p. 129, 130.

The first business twin-jet ever developed by Mitsubishi, the Diamond I, is presented. The many innovations made in the airframe include the use of three-dimensional aerodynamic technology in wing design, the wing profile and configuration specifically tailored to delay boundary layer airflow separation to a higher Mach number (0.78), and minimized drag rise due to Mach-induced separation. The takeoff thrust is 1134 kg and the maximum takeoff weight 6300 kg. The wing has a thickness ratio of 13.2%, and aspect ratio of 7.54, and a loading of 281 kg/sq m. In addition, the Diamond I is equipped with wing spoilers, providing roll control in the absence of conventional ailerons. The length of the cabin is 4.77 m and the width is 1.5 m. Such benefits as various combinations of lower fuel consumption, higher operating speeds and greater payload carrying capability are mentioned. The fully equipped aircraft costs $2.18 million. L.M.

A80-23012 # **Computations of the pitching oscillation of a NACA 64A-010 airfoil in the small disturbance limit.** D. P. Rizzetta and H. Yoshihara (Boeing Military Airplane Co., Seattle, Wash.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0128.* 8 p. 6 refs.

Solutions to three formulations of the unsteady transonic small disturbance problem are compared, each incorporating a different degree of approximation. The first employs the classical low frequency equation and corresponding boundary conditions, the second uses the same equation but more exact boundary conditions, and the third includes both a more exact equation and boundary conditions. A method for simulating viscous effects of shock-boundary layer interaction using a simple viscous displacement ramp is also investigated. The various solutions are compared for the pitching oscillation of a NACA 64A-010 airfoil at M = 0.8. It is shown that the boundary conditions play a more significant role than does the differential equation in obtaining unsteady aerodynamic coefficients. In addition, the viscous interaction was found to have the expected important effects. (Author)

A80-23013 # **Computational and simplified analytical treatment of transonic wing-fuselage-pylon-store interactions.** V. Shankar and N. Malmuth (Rockwell International Science Center, Thousand Oaks, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0127.* 11 p. 9 refs. Contract No. N00014-78-C-0477. NR Project 212-257.

Transonic modified small disturbance theory has been employed to numerically model the flow field around wing-fuselage-pylon-store configurations. A fine grid region enclosing the wing-pylon-store is embedded within a global crude grid and a successive crude-fine relaxation is performed. With a simple image point concept, the store and the pylon are introduced into an existing wing-fuselage program thus avoiding excessive additional computer memory requirements. Comparison of results with experiments for the F-5 wing with a pylon-store arrangement is presented showing good agreement. A study of the roles of pylon height, store diameter, pylon span mount location, angle of attack and Mach number relative to the achieve-ment of optimum L/D from beneficial nonlinear interference is presented. In addition, a simplified analytical approach to compute the loading on the store using an 'immersion theory' is, indicated and validated against experiments. (Author)

A80-23066 # **Technology of adhesive bonding of aircraft parts /2nd revised and enlarged edition/ (Tekhnologiia skleivaniia detalei v samoletostroenii /2nd revised and enlarged edition/).** I. I. Kapeliushnik and I. I. Mikhalev. Moscow, Izdatel'stvo Mashino-stroenie, 1979. 160 p. 49 refs. In Russian.

The handbook provides practical information on the preparation of adhesive metal bonds and on designing adhesive bonded aircraft

structures. The present edition is extended to include data on the properties of advanced adhesives, technological procedures, improved facilities for adhesive bonding, and modern testing techniques. V.P.

A80-23067 # **Designing aircraft-engine air ducts (Proektirovanie vozdukhovodov samoletnykh silovykh ustanovok).** I. E. Ul'ianov, N. N. Krumina, and N. V. Vakar. Moscow, Izdatel'stvo Mashinostroenie, 1979. 96 p. 20 refs. In Russian.

Principles and methods of designing aircraft compressed-air ducts are discussed. Experience in designing ducts with allowance for the characteristics of compressed-air flows is reviewed, and the calculation of air-flow-rate and pressure distributions with allowance for compressibility is illustrated by examples. V.P.

A80-23068 # **Methods of computer-aided aircraft design (Metody avtomatizirovannogo proektirovaniia samoleta).** G. M. Kashin, G. I. Pshenichnov, and Iu. A. Flerov. Moscow, Izdatel'stvo Mashinostroenie, 1979. 168 p. 51 refs. In Russian.

The book deals with methods of generating curves and surfaces for computer-aided design of space forms. Computer algorithms for calculating the stress-strain state of aircraft structures and for optimizing aircraft structures are outlined. V.P.

A80-23069 # **Designing of the test units for aircraft engines (Proektirovanie ispytatel'nykh stendov dlia aviatsionnykh dvigatelei).** Iu. I. Pavlov, Iu. Ia. Shain, and B. I. Abramov. Moscow, Izdatel'stvo Mashinostroenie, 1979, 152 p. 72 refs.

The book deals with designing of the test units for aircraft turbojet engines and their parts. Emphasis is placed on test modeling and modern test units which make it possible to imitate high-speed, take-off-landing, weather, and other conditions under which these engines operate. V.T.

A80-23071 # **Optimization methods in fine-finishing and designing gas-turbine engines (Metody optimizatsii pri dovodke i proektirovanii gazoturbinnykh dvigatelei).** A. P. Tunakov. Moscow, Izdatel'stvo Mashinostroenie, 1979. 184 p. 35 refs. In Russian.

The book deals with methods of optimizing gas-turbine engine parameters and the use of optimized parameters in systems of automatic design. A universal mathematical model of a gas-turbine engine is examined, along with its application to multimode optimization for various control programs. V.P.

A80-23080 # **Introduction to aerospace technology (Vvedenie v aviatsionnuiu i kosmicheskuiu tekhniku).** L. A. Latyshev. Moscow, Izdatel'stvo Mashinostroenie, 1979. 136 p. 16 refs. In Russian.

In this textbook, the student is introduced to the major disciplines of aeronautics and astronautics. Particular attention is given to practical aerodynamics, the theory of rocket engines, and the characteristics of the space environment. A historical review of the development of aviation and space flight is given, and the principal spacecraft and booster types are discussed. The book contains basic information on space vehicle power plants, control systems, and communications. V.P.

A80-23083 # **Production of wide-body aircraft (Proizvodstvo shiroko-fiuzeliazhnykh samoletov).** P. N. Belianin. Moscow, Izdatel'stvo Mashinostroenie, 1979. 360 p. 6 refs. In Russian.

An attempt is made to generalize the experience obtained in the USSR and the United States in designing and constructing wide-body aircraft of the type of Il-86, B-747, DC-10, and L-1011. The design and technological characteristics of each of these aircraft are described. The technological processes involved in the production of aircraft components are examined, along with assembly and testing techniques. V.P.

A80-23084 # **The An-24 aircraft - Design and maintenance /3rd revised and enlarged edition/ (Samolet An-24 - Konstruktsiia i ekspluatatsiia /3rd revised and enlarged edition/).** Zh. S. Chernenko, G. S. Lagosiuk, and B. I. Gorovoi. Moscow, Izdatel'stvo Transport, 1978. 312 p. In Russian.

The basic passenger version of the An-24 turboprop aircraft seats from 44 to 52 passengers, has a cruising speed of 450 kph, a cargo capacity of 5500 kg, and a range of 2000 km. It is powered by two turboprop engines with a take-off power of 2550 ehp each and a turbojet engine with a thrust of 800 kgf. Design features are detailed for the airframe, the power plant, the undercarriage, control systems, and auxiliary equipment. Maintenance procedures are discussed with reference to different climatic conditions. V.L.

A80-23086 # **The reliability of the mechanical components of flight vehicles (Nadezhnost' mekhanicheskikh chastei konstruktsii letatel'nykh apparatov).** A. A. Kuznetsov, A. A. Zolotov, V. A. Komiagin, and M. I. Titov. Moscow, Izdatel'stvo Mashinostroenie, 1979. 144 p. 31 refs. In Russian.

The book examines the operation of separable and rotational flight-vehicle components and determines their reliability requirements. Methods of designing reliability are discussed for stage separation, tail-section separation, and release of the tailcone. Reliability design methods are described for single-link and multilink hinge systems with spring mechanisms. A.T.

A80-23088 # **The operation of airports: Maintenance and upkeep /Handbook/ (Ekspluatatsiia aerodromov: Soderzhanie i remont /Spravochnik/).** L. I. Goretskii, M. A. Pecherskii, V. M. Romashkov, Iu. A. Samorodov, E. M. Dashevskii, T. S. Pchelkina, and Iu. N. Volkov. Moscow, Izdatel'stvo Transport, 1979. 216 p. 24 refs. In Russian.

The handbook contains information on the technology and modern methods of operating, maintaining, and reconditioning of airports. Pertinent data are given on the machines, mechanisms, and materials used for maintaining airport buildings, runways, aprons, etc. Attention is given to methods of protecting pipelines and metallic and other coatings against severe frost and snow conditions, and to the maintenance of hydroplane airports and arctic airports. V.P.

A80-23204 **A plan for active development of LH2 for use in aircraft.** G. D. Brewer (Lockheed-California Co., Burbank, Calif.). In: Hydrogen energy system; Proceedings of the Second World Hydrogen Energy Conference, Zurich, Switzerland, August 21-24, 1978. Volume 5. Oxford and New York, Pergamon Press, 1979, p. 2685-2697. 7 refs.

A plan for an experimental airline equipped with liquid hydrogen (LH2)-fueled aircraft flying commercial cargo between the U.S., Western Europe, and the Middle East is presented. Liquid hydrogen provides lower life cycle cost and consumption and minimum environmental pollution compared with synthetic Jet A fuel made from coal. The plan includes development of facilities for production and liquefaction of hydrogen at four air terminals; the operating experience with the aircraft and ground facilities will be shared to disseminate the information about this system. A.T.

A80-23205 **Electronic fuel injection techniques for hydrogen powered I.C. engines.** C. A. MacCarley and W. D. Van Vorst (California, University, Los Angeles, Calif.). In: Hydrogen energy system; Proceedings of the Second World Hydrogen Energy Conference, Zurich, Switzerland, August 21-24, 1978. Volume 5. Oxford and New York, Pergamon Press, 1979, p. 2747-2792. 32 refs. Research supported by the U.S. Postal Service.

Numerous studies have demonstrated the advantages of hydrogen as a fuel for Otto Cycle engines due to high thermal efficiency

and low exhaust pollutant levels. Characteristic of hydrogen engine operation using pre-mixed intake charge formation is a problem of pre-ignition resulting in an intake manifold 'backfire'. Additional problems include high NOx production when using certain equivalence ratios and power output degradation due to low fuel energy/volume density. Techniques for direct and manifold fuel injection are discussed as means for overcoming these problems. Emphasis is placed on the need for total engine control, integrating control of fuel injection, ignition timing, intake air throttling, and vehicle subsystems within a central electronic unit. An electronically actuated fuel injection valve and a prototype electronic control system are developed. These are applied in manifold and direct injection system geometries, and evaluated in engine testing. System effectiveness and feasibility are discussed. (Author)

A80-23263 **Charging of jet fuel on polyurethane foams.** J. T. Leonard and W. A. Affens (U.S. Navy, Naval Research Laboratory, Washington, D.C.). In: Electrostatics 1979; Conference on Electrostatic Phenomena, 5th, Oxford, England, April 17-20, 1979, Invited and Contributed Papers. Bristol, England, Institute of Physics, 1979, p. 55-65. 5 refs.

Jet fuels were charged electrostatically by flowing through polyurethane foam. Of the two types of foam tested, the polyether-type polyurethane foam was found to be the more active, producing about six times more charge than the polyester-type. However, the magnitude of the charge could not be predicted from the conductivity of the fuel nor on the basis of its tendency to charge on a standard paper filter. (Author)

A80-23283 **Controlling adaptive antenna arrays with the sample matrix inversion algorithm.** L. L. Horowitz, H. Blatt, W. G. Brodsky, and K. D. Senne (MIT, Lexington, Mass.). *(Institute of Electrical and Electronics Engineers, Electronic Show and Convention, New York, N.Y., Apr. 30, 1979.) IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-15, Nov. 1979, p. 840-848. USAF-supported research.

Considerations are given leading to the selection of the sample matrix inversion algorithm for the control of an airborne narrowband adaptive receiving array for use in omnidirectional communications. Performance is measured for a laboratory nulling system which implements this design concept. This performance is compared with predictions based on the component tolerances of the laboratory system. (Author)

A80-23304 # **de Havilland - The changes ahead.** J. W. Sandford (de Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada). *(Canadian Aeronautics and Space Institute, Annual General Meeting, 25th, Ottawa, Canada, May 3, 1979.) Canadian Aeronautics and Space Journal,* vol. 25, 4th Quarter, 1979, p. 317-333.

After a brief discussion on the background of the de Havilland Aircraft of Canada and its current business position, the paper examines future developments and the basic philosophy of the company. The projections of the market environment that will influence the aircraft industries throughout the world are outlined, including the price and availability of the fuel, the age of existing fleets and productivity of new versus old aircraft. The current Twin Otter, Buffalo and DASH 7 aircraft and their derivatives are described. Special attention is given to the DASH X, scheduled for introduction in the first half of the 1980's. It will carry up to 32 passengers and utilize a high wing with a supercritical airfoil section. Its maximum cruise speed will be 260 knots and the other improvements will include reduced fuel consumption per passenger (10-20%), decreased direct operating costs (partly due to turboprop technology), and better unpaved runway capability. L.M.

A80-23306 # **The laminar lightplane or the aircraft performance revolution is upon us.** B. H. Carmichael (Rockwell International Corp., Pittsburgh, Pa.). *Canadian Aeronautics and Space Journal,* vol. 25, 4th Quarter, 1979, p. 341-358. 12 refs.

The paper examines the body of theoretical and experimental literature that is leading to the development of the laminar light aircraft of very high cruising efficiency. The aerodynamic theory of laminar aircraft is reviewed, and certain practical difficulties associated with instability of the laminar boundary layer are considered. Two aircraft configurations, propellar-driven and jet-propelled, with extensive laminar flow possibilities, are described; attention is given to drag estimation and to the determination of maximum speed for these aircraft. Methods for fabricating laminar aircraft are briefly discussed, with attention given to the choice of structural materials. L.M.

A80-23307 # **The potential for development of high performance light aircraft.** D. J. Marsden (Alberta, University, Edmonton, Canada). *(Canadian Aeronautics and Space Institute, Annual General Meeting, 25th, Ottawa, Canada, May 3, 1979.) Canadian Aeronautics and Space Journal,* vol. 25, 4th Quarter, 1979, p. 359-369.

The present study assesses the potential for improved performance of state-of-the-art light aircraft on the basis of available information on overall dimensions, installed power, cruising speed and all-up weight. The contribution to overall drag of undercarriage, engine cooling, and wing profile drag is estimated, and the impact of drag reduction on overall performance is discussed. It is shown that the cruise speed of a typical two-place single-engine aircraft with installed power of 100 hp, all-up weight of 1600 lb, and a cruise speed at 7000 ft altitude of 117 mph can be increased to 137 mph by making the under-carriage retractable and doing some further moderate clean-up of aerodynamic surfaces. Further modifications including a 50% reduction in wing area and addition of a full-span slotted flap to retain low landing speed will increase the cruise speed to 160 mph. More radical configuration changes to increase wing loading and place the propeller at the rear of the fuselage can increase cruising speed to 200 mph with no increase in the installed engine power. Fuel economy will be improved to 45 miles per gallon. L.M.

A80-23335 **Mechanical fasteners dominating aerospace.** J. Mayfield. *Aviation Week and Space Technology,* vol. 112, Feb. 18, 1980, p. 38, 39, 41 (3 ff.).

After a brief review of adhesive bonding, weldbonding, welding, and diffusion bonding, the paper examines mechanical fasteners for the aerospace industry, stressing modifications to design and the use of composite materials. Research on fastener systems compatible with graphite/epoxy composites is discussed, noting the problem of galvanic corrosion. Two types of composite mechanical fasteners, one a two-piece fastener, consisting of thermoset epoxy resin reinforced with glass fibers, the other a single-piece fastener made of thermoplastic polysulfone resin reinforced with glass fibers, are analyzed together with the manufacturing equipment. Also discussed are a four-piece, two-sleeve blind fastener and the use of Teflon coatings on fasteners. L.M.

A80-23351 **The shapes of things to come - An introduction to the capabilities of the British Aerospace Numerical Master Geometry System.** H. G. Mason (British Aerospace, Aircraft Group, Weybridge, Surrey, England). *Aeronautical Journal,* vol. 83, Dec. 1979, p. 483-489. 8 refs.

The purpose of the paper is to give a brief introduction to the scope, flexibility and power of the British Aerospace Numerical Master Geometry System, which is a computer aid for the design and manufacture of complicated three-dimensional curved surfaces. The basis of the mathematical model used by NMG is the parametric bicubic surface which consists of a topologically rectangular grid of bicubic tiles. Attention is given to the applications of the basic systems to three-eleven forward fuselage sections and the hull sections of a luxury yacht. C.F.W.

A80-23371 **The structure-free thrust-doubling of insect-like aircraft - The possibility of using insect-flight /thrust-flight/ on a large technical scale (Die strukturfreie Schubverdopplung insektenartiger Flugzeuge - Eine Möglichkeit, den Insektenflug /Schubflug/ grosstechnisch zu nutzen).** B. de Temple (Rheinland-Pfalz, Fachhochschule, Heidesheim, West Germany). *VDI-Zeitschriften Forschritt-Berichte, Reihe 12 - Verkehrstechnik,* no. 36, Mar. 1979. 291 p. 12 refs. In German.

A80-23373 **Analytical and numerical studies of the effect of aircraft design parameters on the geometry of the circular transition-curve of an optimized transition- and climb-path for the jet-aircraft takeoff (Analytisch-numerische Betrachtungen über den Einfluss einiger Flugzeug-Auslegungsgrössen auf die Geometrie des kreisförmigen Übergangsbogens einer optimierten Übergangs- und Steigstrecke für den Start schneller Strahlflugzeuge).** L. von Bonin (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Strukturmechanik, Braunschweig, West Germany). *VDI-Zeitschriften Fortschritt-Berichte, Reihe 12 - Verkehrstechnik,* no. 37, June 1979. 37 p. 10 refs. In German.

A80-23374 # **Transport phenomena in labyrinth seals of turbomachines (Phénomènes de transport dans les garnitures à labyrinthes des turbomachines).** T. Boyman. Lausanne, Ecole Polytechnique Fédérale, Docteur ès Sciences Techniques Thesis, 1979. 101 p. 27 refs. In French.

The aim of this study is: (1) to investigate mechanisms which cause the undesired transport of contaminating fluid through labyrinth seals of turbomachines in the direction opposite to the buffering-fluid flow and (2) to estimate the contamination level. The study was performed on straight-through-type labyrinth seals with moving fins and a stationary outer cylinder. LDA measurements performed on a large-scale model showed that the transport is mainly due to turbulence caused by rotation of the fins. In the contaminating suspensions it is shown theoretically that the undesired transport occurs through very small particles or droplets and cannot be distinguished from turbulent diffusion. B.J.

A80-23460 * # **Helicopter /RSRA/ in-flight escape system - Component qualification.** L. J. Bement (NASA, Langley Research Center, Hampton, Va.). In: Symposium on Explosives and Pyrotechnics, 10th, San Francisco, Calif., February 14-16, 1979, Proceedings. Philadelphia, Pa., Franklin Research Center, 1979, p. 7-1 to 7-15.

The paper describes the design, development, and qualification approach for the RSRA (Rotor Systems Research Aircraft) system explosive and pyrotechnic components. The approach was based on previous experience and included: (1) the application of good design practice and quality control, (2) a thorough examination of component interfaces through demonstration testing of functional margins, (3) the carrying out of thorough real-world sequential environmental testing, and (4) the operation of environmentally exposed units in subsystem-level tests at temperature, force, and energy limits. Owing largely to this approach, the RSRA became the first helicopter system to contain a fully qualified and operational in-flight escape system. B.J.

A80-23461 # **Development of a hot wire initiated pyrotechnic-propellant gas source for a parachute ejection system.** J. R. Craig (Sandia Laboratories, Albuquerque, N. Mex.) and D. W. Fyfe (Unidynamics/Phoenix, Inc., Phoenix, Ariz.). In: Symposium on Explosives and Pyrotechnics, 10th, San Francisco, Calif., February 14-16, 1979, Proceedings. Philadelphia, Pa., Franklin Research Center, 1979, p. 10-1 to 10-8. Research supported by the U.S. Department of Energy.

A hot wire initiated pyrotechnic-propellant gas source was developed which is used to produce the energy required to deploy a parachute for a parachute ejection system. Deployment mass and ejection velocity were specified as 50 kg and 46 m/s. The gas generator design which evolved has titanium subhydride/potassium perchlorate and boron/potassium nitrate in the pyrotechnic elements and an extruded small grain high temperature resistant propellant type HES 8028 for the gas source. (Author)

A80-23462 # **Pyrotechnic delay cutters for more severe accelleration and temperature environments.** D. H. Brooks and F. J. Valenta (U.S. Navy, Naval Ordnance Station, Indian Head, Md.). In: Symposium on Explosives and Pyrotechnics, 10th, San Francisco, Calif., February 14-16, 1979, Proceedings. Philadelphia, Pa., Franklin Research Center, 1979, p. 12-1 to 12-13. 9 refs.

The U.S. Air Force has experienced failures with in-service reefing line pyrotechnic delay cutters employed in Mid-Air Retrieval Systems (MARS) for remotely piloted vehicle (RPV) recovery. The failures have been attributed to environmental conditions during MARS deployment. The Naval Ordnance Station, Indian Head MD (NAVORDSTA) is currently completing the development of two pyrotechnic delay cutters providing a total of nine different time delays. The cutters are required to operate under sustained high acceleration loading and to a cold temperature extreme of -100 F. Other design features to optimize cutting capability and minimize mechanical pull force initiation levels have also been incorporated. (Author)

A80-23530 **Bit slices in a radar processor.** T. Bucciarelli (Selenia S.p.A., Rome; Perugia, Università, Perugia, Italy), M. Di Lazzaro, and G. Petrocchi (Selenia S.p.A., Rome, Italy). In: Microprocessors: A tool for the future; Electronics Workshop, Lausanne, Switzerland, October 2-4, 1979, Proceedings. Lausanne, Ecole Polytechnique Fédérale de Lausanne, 1980, p. 187-196.

The use of bit slices in a radar processor to improve target detectability is discussed. Depending on the particular need, different bit sizes are incorporated; 8 when cancellation for clutter is needed and 12 for better tracking precision. Attention is given to pipeline processing, a parallel processor and to tracking radars. C.F.W.

A80-23799 **Safety and comfort - The airliner cabin.** I. Goold. *Flight International,* vol. 117, Feb. 16, 1980, p. 479-484.

Airworthiness requirements governing the design of seats and the strength tests to be applied are outlined. Specifications for the testing of the flame resistance of cabin materials are presented. Finally, tradeoffs necessary to ensure passenger comfort are discussed. B.J.

A80-23858 **Variations in crack growth rate behavior.** M. E. Artley, H. D. Stalnaker (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio), and J. P. Gallagher (Dayton, University, Dayton, Ohio). In: Fracture mechanics; Proceedings of the Eleventh National Symposium, Blacksburg, Va., June 12-14, 1978. Part 1. Philadelphia, Pa., American Society for Testing and Materials, 1979, p. 54-67. 11 refs.

Three variable amplitude stress histories based on a single repeating flight of a bomber aircraft are applied to center-crack panels of 7075-T6 aluminum. The stresses in each stress history are controlled so that the stress intensity factor coefficient is constant as the crack grows; the resulting fatigue crack growth (FGG) data show that the derived variable amplitude fatigue crack growth rate (FCGR) behavior is controlled by a stress intensity factor parameter. With the increased crack length measurement interval, the FCGR variability

associated with the secant method of differentiation decreases to the almost constant level of FCGR variability exhibited by the seven-point incremental polynomial method. A.T.

A80-23876 * **Stress-intensity factors for two symmetric corner cracks.** I. S. Raju and J. C. Newman, Jr. (NASA, Langley Research Center, Hampton, Va.). In: Fracture mechanics; Proceedings of the Eleventh National Symposium, Blacksburg, Va., June 12-14, 1978. Part 1. Philadelphia, Pa., American Society for Testing and Materials, 1979, p. 411-430. 17 refs.

This paper presents stress-intensity factors, calculated by a three-dimensional finite-element analysis, for shallow or deep quarter-elliptical corner cracks at the edge of a hole in a finite-thickness plate. The plate was subjected to remote uniform tension, remote bending, or simulated pin loading in the hole; a wide range of configuration parameters was investigated. To verify the accuracy of the three-dimensional finite-element models employed, convergence was studied by varying the numbers of degrees of freedom. The stress-intensity factor variations along the crack front are compared with solutions from the literature. (Author)

A80-23900 **Near-wake structure and unsteady pressures at trailing edges of airfoils.** W. K. Blake and L. J. Maga (U.S. Naval Material Command, David W. Taylor Naval Ship Research and Development Center, Bethesda, Md.). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 69-75. 10 refs. Navy-supported research.

Experimental measurements show that flow-induced pressures on trailing edges with motion are due exclusively to the intensified vortex system and not to other near-field effects. The increase is nearly proportional to y(rms)/h and is apparently independent of wind speed over the range studied. The important factor from the viewpoint of hydroelastic phenomena is the well-defined phase relationship which is apparently dependent primarily on omega(v)/omega(s) and not on displacement amplitude and wind speed, at least over the parameter range studied. B.J.

A80-23901 * **Investigation of trailing-edge noise.** T. F. Brooks (NASA, Langley Research Center, Hampton, Va.) and T. H. Hodgson (North Carolina State University, Raleigh, N.C.). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 76-84. 6 refs. Grant No. NsG-1377.

A comprehensive experimental investigation of airfoil trailing-edge noise up to a Reynolds number based on chord of 2.96 x 10 to the 6th power is described. Comparisons are made with current theory, particularly with regard to the pressure field in the vicinity of the trailing-edge and its influence on the radiated noise. (Author)

A80-23902 **Modelling low Mach number noise.** W. Möhring (Max-Planck-Institut für Strömungsforschung, Göttingen, West Germany). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 85-96. 13 refs.

Often the calculation of sound generation to lowest order in Mach number by a flow requires the solution of a linear problem once the fluid motion is known. Several theories are developed which relate the generated sound to different quantities of the incompressible flow. Basic equations of low Mach number noise are derived, and attention is given both to the two-dimensional and three-dimensional flow problems. B.J.

A80-23903 * **A study of production and stimulated emission of sound by vortex flows.** J. E. Yates (Aeronautical Research Associates of Princeton, Inc., Princeton, N.J.). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 97-106. 7 refs. Contracts No. NAS1-14503; No. NAS1-15033.

The noise radiated by an elementary corotating vortex pair in a shear flow is calculated. It is shown that a small shear can substantially increase the noise while small reverse shears can annihilate vortex pairs and thus reduce the pair noise mechanism. The resonant excitation of an ensonified vortex pair and the broadband noise amplification of a six vortex cluster is calculated. The results are in qualitative agreement with recent experimental findings on jet broadband noise amplification. (Author)

A80-23909 **Theory of cross-spectral densities of jet noise.** W. Richarz (Toronto, University, Toronto, Canada). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 153-159. 12 refs. Research sponsored by the Natural Sciences and Engineering Research Council of Canada.

The present investigation is an extension and development of Ribner's theory of broadband correlations between two microphones in the far field of a jet. The jet flow is modelled in much more detail and the theory is extended into the frequency domain. Theoretical predictions of coherence over a range of Strouhal numbers compare favourably with experimental results of several investigators. As in the broadband case, two mechanisms appear to shape the patterns of the cross-spectra: namely the instantaneous directivity of the sources and the non-compactness of the source region. (Author)

A80-23910 **Some analytical consideration in jet noise prediction.** C. H. Berman (Boeing Commercial Airplane Co., Seattle, Wash.). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 160-166. 12 refs.

A singularity in the Lilley equation, which describes the generation and propagation of sound in turbulent flows, is removed by retaining a nonlinear term. Next, it is shown how the scattering of either sound or instability waves by turbulence can produce sound more efficiently than turbulent mixing alone. (Author)

A80-23916 **A ray-theory approach for high-frequency engine-intake noise.** A. J. Kempton (Rolls-Royce, Ltd., Derby, England). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 203-209.

This paper illustrates the feasibility of incorporating a ray-theory approach in the prediction of high-frequency engine-intake noise. It is shown that, for the frequencies and observation angles of most interest, diffraction by the intake lip can be neglected and ray theory used in its most simple form to model the propagation of the forward-radiated broadband fan noise of a typical high-bypass-ratio aero engine. It is also shown that when liners are introduced the sound attenuation at any one angle in the far-field is largely independent of the source (or modal) distribution. This suggests that it might be possible to assess the effects on fan noise of different liners without the need for a precise description of the source. (Author)

A80-23922 **Importance of jet temperature on the prediction of jet noise in flight.** A. Michalke (Berlin, Technische Universität, Berlin, West Germany) and U. Michel (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Berlin, West Germany). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 256-263.

It is shown that a theoretical prediction of jet noise from aircraft in flight can be achieved, when the static directivities of jet noise are known, and the ratio of flight speed to jet velocity is small. It is found that the jet temperature ratio and the axially stretching of the turbulent flow field have an important influence on the prediction of jet noise in flight. (Author)

A80-23923 * **Excess noise from supersonic underexpanded jets in flight.** I. V. Sarohia, S. P. Parthasarathy, P. F. Massier (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and G. Banerian (NASA, Research and Technology Div., Washington, D.C.). In: Mechanics of sound generation in flows; Proceedings of the Joint Symposium, Göttingen, West Germany, August 28-31, 1979. Berlin, Springer-Verlag, 1979, p. 264-274. 15 refs. Contract No. NAS7-100.

A combination of flow visualization and measurement of both the near and far-field radiated noise of supersonic underexpanded jets under simulated flight conditions has led to the identification of a mechanism of excess jet noise production. It was observed that large lateral oscillations were imparted to the entire jet by the complex interaction of the outer flow with the jet. These jet oscillations appeared to develop almost abruptly into large oscillations becoming fully developed at about 6 to 10 diameters downstream of the nozzle exit at a location where the jet became subsonic. This lateral jet motion was observed to be planar and was accompanied by the production of weak shock waves. These weak shock waves existed in 'localized' circumferential regions outside the jet, e.g., quadrants or portions thereof and traveled upstream. It was determined that the measured excess noise was produced by these weak shock waves. Neither the jet oscillations nor the excess noise existed when there was no outer flow around the supersonic underexpanded jet. (Author)

A80-23932 # **Computational transonic analysis for a supercritical transport wing-body configuration.** E. G. Waggoner (Vought Corp., Dallas, Tex.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0129.* 13 p. 11 refs.

A small disturbance transonic analysis code coupled with a two dimensional boundary layer code has been used to calculate the flow field effects of a wing planform and root section changes on a supercritical wing-body transport configuration. Modifications were made to the analysis code in the early phase of the effort which significantly improved the comparisons of experimental and computed wing pressure distributions on the current configurations. These modifications involved the global grid system spacing near the wing and the interpolation scheme for wing coordinates intermediate to the defining stations. Computations were performed on a baseline configuration and two variant configurations. Comparisons are presented between the computed aerodynamic forces, moments and wing pressure distributions and experimental data obtained from tests conducted in the Langley 8-foot transonic pressure tunnel. The comparisons show that the computational results are sensitive to subtle design modifications and that the code could be used as an effective guide during the design process for transport configurations. (Author)

A80-23933 * # **Simulated transonic flows for aircraft with nacelles, pylons, and winglets.** C. W. Boppe and M. A. Stern (Grumman Aerospace Corp., Bethpage, N.Y.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0130.* 17 p. 14 refs. Contract No. NAS1-14732.

A computational method which simulates transonic flow about wing-fuselage configurations has been extended to include the treatment of multiple body and non-planar wing surfaces. The finite difference relaxation scheme is characterized by a modified small disturbance flow equation and multiple embedded grid system. Wing-body combinations with as many as four nacelles/pods, four pylons, and wing-tip-mounted winglets can be analyzed. A scheme for modeling inlet spillage and engine exhaust interference effects has been included. Computed results are correlated with experimental data for three transport configurations. (Author)

A80-23936 # **Mixer nozzle noise characteristics.** A. P. Pennock (Lockheed-Georgia Co., Marietta, Ga.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0166.* 5 p.

Thirteen turbofan mixer nozzle models were tested for performance and noise with heated primary flow. At takeoff pressure ratio the following were found: the test nozzle spectra were similar in shape and peak frequency to the baseline coplanar spectra, and therefore, mixer nozzle noise was approximated by coplanar nozzle noise plus or minus an increment that varied with design, primary flow temperature, and angle; noise was relatively insensitive to mixing section length and to the number of lobes on lobed primary nozzles, and with a heated primary the OASPL reduction at the high-noise aft angles was about 5.5 dB for the lobed mixers and 2 to 3 dB for the simpler designs, compared with 7.5 dB for complete mixing. (Author)

A80-23940 # **Advanced strategic aircraft concepts.** C. D. Wiler and D. P. Raymer (Rockwell International Corp., North American Aircraft Div., Los Angeles, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0188.* 7 p. Contract No. F33615-77-C-0115.

Some approaches are proposed for the next generation of manned strategic aircraft, which are expected to utilize revolutionary approaches to configuration design, structures, and the various subsystems. Attention is given to the areas of propulsion and structural materials which will contribute greatly to lighter and cheaper aircraft. Such aircraft will be able to fly further without refuelling while using considerably less fuel and with lower maintenance requirements. They will also be smaller and less vunerable, while carrying advanced navigation aids to permit unprecidented accuracy. M.E.P.

A80-23942 # **The nonlinear supersonic potential flow over delta wings.** B. Grossman and M. J. Siclari (Grumman Aerospace Corp., Bethpage, N.Y.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0269.* 13 p. 19 refs. Contract No. F33615-77-C-3126.

A numerical procedure has been developed for the computation of the steady, inviscid supersonic flow over aircraft configurations. The technique accounts for major nonlinear effects (shock waves, blunt leading edges) at low to moderate supersonic speeds. A fully implicit marching technique for the full potential equation is utilized in a stereographically projected, conformally mapped, spherical coordinate frame. Cross-flow planes are efficiently solved by type-dependent relaxation techniques. Results are presented for several delta wing configurations and bodies of revolution, and are compared with existing experimental data, Euler's equations solutions and results from linearized theories (panel methods). (Author)

A80-23950 * # **Thermostructural analyses of structural concepts for hypersonic cruise vehicles.** A. H. Taylor (Kentron International, Inc., Hampton, Va.) and L. R. Jackson (NASA, Langley Research Center, High-Speed Aerodynamics Div., Hampton, Va.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0407.* 12 p. 9 refs.

A matrix of structural concepts suitable for Mach 5 hydrogen-fueled hypersonic vehicles are defined, and a thermostructural analysis of each is presented. The thermal environment encountered

in this flight regime mandates hot structures of superalloy materials or insulated structures using more conventional materials such as titanium, aluminum, and composites. This paper compares the thermostructural performance of several concepts. The various structures are initially sized to carry a 2.5 g subsonic maneuver load. The structural weights are determined, and these components are then evaluated in a transient heating program along with various thermal protection systems to determine the minimum weight combination. The temperature profiles generated for these minimum weight solutions are used as input to a structural analysis along with a model of the appropriate structural concept to calculate thermal stresses. Generally, hot structure concepts have higher thermal stresses. In most cases, the thermal stresses are below the yield strength of the material. It is shown that integral tanks have weights similar to nonintegral tank concepts for the same level of technology. Moreover, an insulated tubular aluminum-composite structure with nonintegral tanks appear attractive for near-term vehicles. (Author)

A80-23962 **All-Equipment Production Reliability Tests /AEPRT/ for the F-15.** J. H. Boiles (McDonnell Aircraft Co., St. Louis, Mo.). In: Environmental stress screening of electronic hardware; Proceedings of the National Conference and Workshop, San Jose, Calif., February 28-March 2, 1979. Mt. Prospect, Ill., Institute of Environmental Sciences, 1979, p. 19-23; Discussion, p. 24. 5 refs.

Although the production reliability sample tests identified many equipment problems which were subsequently corrected, a substitute reliability test plan, identified as All-Equipment Production Reliability Test (AEPRT), was implemented for several of the F-15 equipments to improve test effectiveness. This plan imposed a minimum failure-free operating period on all equipment in lieu of longer tests of samples from the lot. V.T.

A80-23970 **Principles of electronic warfare - Radar and EW.** W. A. Davis (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *Microwave Journal,* vol. 23, Feb. 1980, p. 52-54, 56-59.

The basic forms of radar are considered, and the various forms of electronic countermeasures and counter-countermeasures are briefly described. The goal of this review is to describe the philosophy of electronic warfare and not to catalog the numerous specific techniques. B.J.

A80-23980 # **A rotor supported without contact - Theory and application.** H. Ulbrich (München, Technische Universität, Munich, West Germany), G. Schweitzer (Zürich, Eidgenössische Technische Hochschule, Zurich, Switzerland), and E. Bauser (Max-Planck-Institut für Festkörperforschung, Stuttgart, West Germany). In: World Congress on the Theory of Machines and Mechanisms, 5th, Montreal, Canada, July 8-13, 1979, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1979, p. 181-184. 7 refs.

A rotor is supported contactless and without any wear by using electromagnetic bearings. In addition, the dynamical behavior of the rotor is optimized by controlling the bearing forces according to a specified control law. The control depends on the complete rotor state, which is obtained from limited measurement information through a minimal order observer. The electromagnetic actuators have been developed as selfcontained bearing elements. Due to their linear input/output characteristic they can be easily integrated into the multivariable control loop of the rotor-bearing-system. The theoretical results are corroborated by experiments. The rotor was developed for application in liquid-phase epitaxial growth of very thin semiconductor layers. For this purpose, a very smooth rotation is required in a reactor which is leak-proof even under ultrahigh-vacuum conditions. An active suspension was necessary in order to absolutely exclude contamination by lubricants or wear. (Author)

A80-23988 # **Vibrational modes of an aircraft simulator motion system.** R. Hoffman (McGill University, Montreal, Canada) and M. G. McKinnon (CAF Electronics, Ltd., Montreal, Canada). In: World Congress on the Theory of Machines and Mechanisms, 5th, Montreal, Canada, July 8-13, 1979, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1979, p. 603-606. 5 refs.

This paper describes how the vibrational characteristics of an aircraft simulator motion system are analyzed by means of the finite element computer program SAP IV. The motion system mechanism consists of a platform supported by six independent hydraulic servocylinders pivoted at each end thus allowing the platform to be moved in space with six degrees of freedom. It is desired to obtain the natural frequencies and mode shapes of the vibrations arising from both the compressibility of the oil in the cylinders and the bending-mode flexibility of the cylinders themselves. It is shown that SAP IV is an efficient tool to analyze the mechanical system but that the effects of feedback control of the servo space cylinders cannot readily be included. (Author)

A80-24027 **Aircraft collisions.** E. L. Wiener (Miami, University, Miami, Fla.). In: Human Factors Society, Annual Meeting, 23rd, Boston, Mass., October 29-November 1, 1979, Proceedings. Santa Monica, Calif., Human Factors Society, Inc., 1979, p. 26-29. 9 refs.

The paper examines collisions from a human factors perspective, seeing them as 'system-induced errors' resulting from control systems that stress regulation and airspace allocation, and do not properly consider the human operator. It is argued that in order to avoid future accidents, system designers must consider such topics as basic assumptions in air traffic control, mixed IFR and VFR navigation, pilot-controller and controller-controller communications, extra-cockpit vision, workload of pilots and controllers, proposed regulations, and instrumentation. M.E.P.

A80-24089 # **The proposed Boeing Supersonic Wind Tunnel high Reynolds number insert.** E. G. Hill (Boeing Co., Seattle, Wash.). In: International Symposium on Cryogenic Wind Tunnels, 1st, Southampton, England, April 3-5, 1979, Proceedings. Southampton, University of Southampton, 1979, p. 33.1-33.4.

Modification of the frequently used Boeing Supersonic Wind Tunnel (BSWT) to provide high Reynolds number testing capabilities is presented. The modified BSWT is called The Boeing High Reynolds Number Tunnel, BHRT. Design and flow and data requirements are outlined along with circuit development. V.T.

A80-24090 * # **Full scale aircraft simulation with cryogenic tunnels and status of the National Transonic Facility.** R. A. Kilgore, W. B. Igoe, J. B. Adcock, R. M. Hall, and C. B. Johnson (NASA, Langley Research Center, Hampton, Va.). In: International Symposium on Cryogenic Wind Tunnels, 1st, Southampton, England, April 3-5, 1979, Proceedings. Southampton, University of Southampton, 1979, p. 11.1-11.18; Discussion, p. 11.19. 29 refs.

The paper reviews the results of some of the real-gas studies made at Langley that are directly related to establishing the range of operating conditions that can be used in a cryogenic nitrogen wind tunnel and still be assured of valid full-scale simulation. Consideration is given to the important aerodynamic features, anticipated performance capability, status of construction, and projected operating data for the National Transonic Facility. V.T.

A80-24092 # **Progress report on a cryogenic pilot transonic wind tunnel driven by induction.** A. Blanchard and D. Faulmann (ONERA, Centre d'Etudes et de Recherches de Toulouse, Toulouse, France). In: International Symposium on Cryogenic Wind Tunnels,

1st, Southampton, England, April 3-5, 1979, Proceedings. Southampton, University of Southampton, 1979, p. 13.1-13.11.

The paper examines the layout and operating methods of a wind tunnel 1/10th the scale of an existing pressurized transonic wind tunnel. A new solution for increasing the Reynolds numbers with smaller sized wind tunnels is considered. It is concluded that a promising solution to increase the Reynolds numbers without producing too many technological problems seems to be found by employing a short cryogenic operating run, in which the cooling is ensured by a quick injection of liquid nitrogen in the return leg circuit. C.F.W.

A80-24138 # **Design for continuing structural integrity.** E. K. Walker, J. C. Ekvall, and J. E. Rhodes (Lockheed-California Co., Burbank, Calif.). *ASME, Transactions, Journal of Engineering Materials and Technology*, vol. 102, Jan. 1980, p. 32-39.

This paper addresses the structural integrity planning that takes place during the design development process of commercial aircraft. Subjects discussed include the evolutionary nature of the process, the need for continued planning during service, the role of simplistic envelope criteria, and the basic concepts underlying analyses used in the planning process. Examples include in-service planning for older aircraft and design development for continued structural integrity of a modern wide-body transport. Concluding remarks discuss how the process will be applied to the next generation of aircraft. (Author)

A80-24140 # **Low cycle fatigue life model for gas turbine engine disks.** T. G. Meyer and T. A. Cruse (United Technologies Corp., Pratt and Whitney Aircraft Group, East Hartford, Conn.). *ASME, Transactions, Journal of Engineering Materials and Technology*, vol. 102, Jan. 1980, p. 45-49. 5 refs. Contract No. F33615-75-C-2063.

A low cycle fatigue (LCF) life exhaustion method is developed for gas turbine engine disks subjected to complex mission history loading. The method is incorporated into an algorithm for LCF life exhaustion prediction as a function of component, material, mission history, and mission ordering. Principal features in the LCF life model include a simple strain range-mean stress correlation model, a predictive model for the effects of strain-hardened surface layers due to machining and the effects of dwell (creep) due to elevated temperature exposure time, a fracture mechanics-based nonlinear, cumulative damage model, and full-scale component verification. (Author)

A80-24242 * **Frequency dependent precompensation for dominance in a four input/output theme problem model.** R. M. Schafer and M. K. Sain (Notre Dame, University, Notre Dame, Ind.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 348-353. 8 refs. Grant No. NsG-3048.

This paper reports on additional experience in applying the CARDIAD methodology to design of dynamical input compensation to achieve column dominance for linear multivariable models of realistic turbine engine simulations. In particular, the approach has been extended to models having four inputs and four outputs, and successful compensations have been achieved with an investment of about thirty minutes desk time. (Author)

A80-24244 * **Design of a turbojet engine controller via eigenvalue/eigenvector assignment - A new sensitivity formulation.** S. R. Liberty, R. A. Maynard, and R. R. Mielke (Old Dominion University, Norfolk, Va.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 359. Grant No. NsG-1519.

This brief paper summarizes the approach the authors will take in designing a feedback controller for the F-100 turbofan engine. The technique to be utilized simultaneously realizes dominant closed-loop eigenvalues, approximates specified modal behavior, and achieves low eigensystem sensitivity with respect to certain plant parameter variations. (Author)

A80-24246 **Multivariable synthesis with inverses.** J. L. Peczkowski (Bendix Corp., South Bend, Ind.), M. K. Sain (Notre Dame, University, Notre Dame, Ind.), and R. J. Leake (California State University, Fresno, Calif.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 375-380. 5 refs.

The application of total synthesis (TS) methods to the design of controller dynamics for linear multivariable models of realistic turbine engine simulations is illustrated. TS methods provide the designer with a capability to specify thoroughly and directly the nominal dynamic relationship between command or request variables and controlled or response variables. Under reasonable assumptions, this capability can include transient response as well as limiting values, and of course internal stability. Particular stress is placed upon the inverse total synthesis problem (ITSP), which emphasizes the inverse of the plant input/output relation, expressed typically as a matrix of transfer functions. In numerous case studies, the ITS approach has shown an ability to preserve designer insight and influence, and has turned out to be relatively easy to understand; both properties are of importance for general control applications. (Author)

A80-24247 **Failure accommodation in gas turbine engines with application to fan turbine inlet temperature reconstruction.** R. K. Sahgal and R. J. Miller (United Technologies Corp., Pratt and Whitney Aircraft Group, West Palm Beach, Fla.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 381-386. 14 refs.

An observer based procedure to eliminate excessive sensor redundancy and to reconstruct output of failed sensors is considered. A dyadic observer, driven by reliable sensor outputs is designed to reconstruct the output of failed sensors. To obviate large feedback gain terms, the observer design is considered within a constrainted optimization setting. The procedure is applied to the reconstruction of the principal protection parameter of the F100 gas turbine engine, fan turbine inlet temperature (T45) based on reliable sensor measurements. It is shown that accurate reconstruction of T45 is achieved and that this procedure is robust. (Author)

A80-24248 **An application of model-following control.** J. D. Aplevich (Waterloo, University, Waterloo, Ontario, Canada). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 393-398. 17 refs. Research supported by the Natural Sciences and Engineering Research Council of Canada.

The feasibility of implicit model-following by the sequential process of exact model-matching and then approximating the result for improved realizability or sensitivity is partially tested in this paper. A time-domain input-output system description is used as a vehicle for removing numerical difficulties previously shown to exist for a reduced model of the F100 engine. A brief test is also performed on the canonical 30-state model. (Author)

A80-24257 **Parameter sensitivity in time varying linear systems, with an application to the dynamics of VTOL aircraft.** R. V. Ramnath (Charles Stark Draper Laboratory, Inc.; MIT, Cambridge,

Mass.) and S. Radovsky (Charles Stark Draper Laboratory, Inc., Cambridge, Mass.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 609-616. 12 refs.

The problem of sensitivity to parameter variations of slowly time varying linear systems is investigated. Useful asymptotic approximations to the sensitivities are developed by the generalized multiple scales method. The technique is applied to evaluate the sensitivities of VTOL aircraft dynamics during transition from hover to forward flight, to changes in the stability derivatives of the aircraft. A comparison of the results by these methods shows good agreement for the two- and three-degree-of-freedom motion of the vehicle. (Author)

A80-24261 **Frequency-domain control design for variable linear systems.** M. B. Callaham (Charles Stark Draper Laboratory, Inc., Cambridge, Mass.) and R. V. Ramnath (Charles Stark Draper Laboratory, Inc.; MIT, Cambridge, Mass.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 634-637. 6 refs. Research supported by Charles Stark Draper Laboratory Independent Research and Development Program.

This paper describes a new method for frequency-domain control design and performance analysis of time-dependent continuous linear systems. In this approach the frequency response of a variable linear system is represented by a system function H(s,t), which is defined as the Laplace transform of the system transition matrix F(t,r) with respect to r. A system function cannot generally be calculated symbolically in closed form; this problem is circumvented by approximating the system function by an asymptotic expansion obtained using the generalized method of multiple scales. Although the algebra of system functions is noncommutative, a concept of 'asymptotic commutativity' is introduced and exploited in a design procedure which allows frequency-domain design principles to be invoked while preserving mathematical rigor and thereby avoiding several pitfalls to which nonrigorous 'quasi-static' analysis is subject. (Author)

A80-24266 **Optimal output feedback for systems having direct feedthrough of control.** S. M. Rock and R. L. De Hoff (Systems Control, Inc. /Vt/, Palo Alto, Calif.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 872-876. 7 refs. Contract No. F33615-77-C-2096.

A common situation in the LQG formulation of the multivariable control problem is that outputs, rather than states are available for control law implementation. The disadvantages to the state reconstruction solution include modeling uncertainty, a large additional complexity, parameter sensitivity, and uncertain channel failure behavior. An alternate to state reconstruction is proportional feedback of the output variables. A method of designing output feedback control laws is discussed. Formulation of the iterative algorithms which incorporate a fixed structure (partial feedback) gain matrix for systems with direct feedthrough of the control is shown. In addition to the minimization of a standard, quadratic cost functional, a procedure for including steady state accuracy and tracking performance directly into the objective function is discussed. The approach is illustrated on a multivariable regulator design for a variable cycle turbofan engine model. (Author)

A80-24267 **Optimal design of a linear sampled data control system using round robin output feedback.** N. H. McClamroch (Michigan, University, Ann Arbor, Mich.). In: Joint Automatic Control Conference, Denver, Colo., June 17-21, 1979, Proceedings. New York, American Institute of Chemical Engineers, 1979, p. 891-894. Research supported by the Bendix Corp.

A linear optimal control problem is defined; the main feature of the problem is a constraint that the control be piecewise constant, as in a sampled data system, and that updating of the control values depends on prior sampled values of the output variables. Such constraints may arise as a consequence of the use of a microcomputer as part of the control and signal processing logic. The mathematical optimal control problem is shown to be equivalent to a standard optimal sampled data control problem. The optimal feedback gains for the original problem are obtained using this equivalence. The use of optimal closed loop eigenvalues as measure of performance of an optimal system is suggested. The results are applied to a problem of controlling the glide slope error for an aircraft. (Author)

A80-24310 **Effects of idealizing three-dimensional geometry with two-dimensional models in temperature and stress analysis of engine components.** N. Sandsmark (Norske Veritas, Oslo, Norway) and O. T. Saugerud. In: Numerical methods in thermal problems; Proceedings of the First International Conference, Swansea, Wales, July 2-6, 1979. Swansea, Wales, Pineridge Press, Ltd., 1979, p. 585-594. 8 refs.

The investigations described in the present paper showed that the common practice of applying two-dimensional models to thermal problems for three-dimensional models should be treated with care to avoid misleading results. A primary requirement for stress analysis is that the load and the general stiffness properties of the component be represented adequately by the basic two-dimensional model. For analysis of design details, in particular for optimization purposes, two-dimensional models can be used to good advantage using boundary conditions from a three-dimensional analysis. V.P.

A80-24360 **Experiments on the diffraction of weak blast waves - The von Neumann paradox.** L. F. Henderson and A. Siegenthaler (Sydney, University, Sydney, Australia). *Royal Society (London), Proceedings, Series A - Mathematical and Physical Sciences,* vol. 369, no. 1739, Feb. 12, 1980, p. 537-555. 21 refs. Research supported by the Australian Research Grants Committee.

The results of experiments with weak incident shocks diffracting over concave corners are presented. For Mach reflection, the experiments reveal a fundamental difference between weak and strong shock diffraction, namely, that for weak shock diffraction the corner signal can always catch up with the three-shock confluence, but this does not happen for strong shock diffraction except for comparatively small corner angles. By taking into account the attenuating effect of the corner signal, it is possible in principle to modify the well-known von Neumann theory which is then in good agreement with the experimental data. Another effect of the corner signal is to cause a partial loss of the self-similarity property of the three-shock system. The modified theory can be extended to include the persisted regular reflection phenomenon suggesting that this is an unresolved Mach reflection. In that event there is some experimental evidence that transition to Mach reflection would then be consistent with the normal shock point as Henderson and Lozzi found for strong shock diffraction. (Author)

A80-24382 **Airborne radar - Evolution and diversification (Les radars aéroportés évolution et diversification).** H. Poinsart (Thomson-CSF, Division Equipements Avioniques, Malakoff, Hauts-de-Seine, France). *Navigation* (Paris), vol. 28, Jan. 1980, p. 28-37. In French.

The operation and utilization of airborne radar are reviewed with reference to the Cyrano, Iguane, and Agave systems. Particular consideration is given to identification procedures, digital processing techniques, pulse compression for precision range measurement, and electronic scanning for flexibility. B.J.

A80-24383 **North Atlantic MNPS . . . 1980 (Atlantique du Nord M.N.P.S. . . . 1980).** J. Fournier and J. Hamelin (Compagnie Nationale Air France, Paris, France). *Navigation* (Paris), vol. 28, Jan. 1980, p. 49-62. In French.

The paper examines current Minimum Navigation Performance Specifications (MNPS) for aircraft flying in the North Atlantic area. The discussion is based on the IATA general document of August 1979 concerning these specifications. Some general recommendations of how to improve the North Atlantic MNPS are presented. B.J.

A80-24472 **Airliner simulator census.** D. Velupillai. *Flight International,* vol. 117, Feb. 23, 1980, p. 570-574, 581-584.

The most recent advances in airliner simulator technology are surveyed, noting that the operating cost of a simulator is only about one tenth that of an airliner. It is shown that simulator manufacturers have improved their products to a point that was not believed possible so soon. Simulator computers now typically employ 32-bit long words which allow more accurate modeling. Attention also is given to advances in hydraulics which allow more faithful duplication of aircraft characteristics, especially ground effects and ground handling. Finally, a listing of which simulators are used by major airlines is presented. M.E.P.

A80-24536 **Crack-detectives foil aircraft failure.** J. F. Mason. *IEEE Spectrum,* vol. 17, Feb. 1980, p. 47-53.

The paper examines better nondestructive evaluation methods that are being sought by commercial and military aviation companies to reduce the possibilities of in-flight aircraft failure. Attention is given to an advanced ultrasonic system that has demonstrated significantly enhanced accuracy and reliability. Methods of detecting surface or near-surface flaws in electrically conductive materials are investigated. C.F.W.

A80-24712 **An overview of the NAVSTAR Global Positioning System and the Navy Navigation Satellite System.** R. W. Hill (U.S. Navy, Naval Surface Weapons Center, Dahlgren, Va.). In: Astrodynamics 1979; Proceedings of the Conference, Provincetown, Mass., June 25-27, 1979. Part 1. San Diego, Calif., American Astronautical Society; Univelt, Inc., 1980, p. 21-32. 15 refs. (AAS 79-108)

The NAVSTAR Global Positioning System is being developed to provide continuous three dimensional navigation on a world-wide basis in the mid-1980's. The satellite system will consist of 6 satellites in 12 hour 'constant ground track' orbits inclined at 63 deg in its development phases, and will expand to a 24 satellite constellation for the operational phase. This paper presents an overview of the space and ground segments for the two satellite based navigation systems. (Author)

STAR ENTRIES

N80-16024*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA QUIET SHORT-HAUL RESEARCH AIRCRAFT EXPERIMENTERS' HANDBOOK
Robert C. McCracken Jan. 1980 29 p
(NASA-TM-81162; A-8053) Avail: NASA. Ames Research Center, Moffett Field, Calif. 94035 CSCL 02A

A summary of guidelines and particulars concerning the use of the NASA-Ames Research Center Quiet Short-Haul Research Aircraft for applicable flight experiments is presented. Procedures for submitting experiment proposals are included along with guidelines for experimenter packages, an outline of experiment selection processes, a brief aircraft description, and additional information regarding support at Ames. J.M.S.

N80-16027 Cincinnati Univ., Ohio.
MAXIMUM LIKELIHOOD IDENTIFICATION OF AIRCRAFT PARAMETERS WITH UNSTEADY AERODYNAMIC MODELLING Ph.D. Thesis
Dinesh Achyut Keskar 1979 105 p
Avail: Univ. Microfilms Order No. 8002115

A simplified aerodynamic force model based on the physical principle of Prandtl's lifting line theory and trailing vortex concept has been developed to account for unsteady aerodynamic effects in aircraft dynamics. An indicial lift function associated with circulation has been derived for tapered, swept wings in incompressible flow by representing the wings with a simple vortex system. Similarly, an equation is developed to compute downwash at the tail caused by wing lift. The equations derived are approximated by the convenient exponential functions. A family of curves is plotted for the constants in the exponential functions for various aspect ratios, taper ratios and sweep angles at the wing quarter-chord line. The results from these approximations compare well with the limited available results from more rigorous and complex methods. Dissert. Abstr.

N80-16029 Engineering Sciences Data Unit, London (England).
AVERAGE GUST FREQUENCIES SUBSONIC TRANSPORT AIRCRAFT
1979 43 p Supersedes ESDU-69023
(ESDU-69023-A-B-C; ESDU-69023; ISBN-0-85679-259-4) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $578.50

Data is provided for compilation of the cumulative frequency gust spectrum experienced by an aircraft structure. An estimation of fatigue loading encountered by aircraft wing structures in flight is presented. ESDU

N80-16030*# McDonnell Aircraft Co., St. Louis, Mo.
INVESTIGATION OF GROUND EFFECTS ON LARGE AND SMALL SCALE MODELS OF A THREE FAN V/STOL AIRCRAFT CONFIGURATION
E. P. Schuster, T. D. Carter, and D. W. Esker Jul. 1979 149 p refs
(Contract NAS2-9690)
(NASA-CR-152240; MDC-A5702) Avail: NASA. Ames Research Center, Moffett Field, Calif. Attn: Hervey Quigley CSCL 01A

Induced lift of a subsonic, three fan, lift/cruise, V/STOL aircraft configuration was investigated using scale modes of a multimission aircraft whose design incorporates a nose mounted lift fan and two lift/cruise units located over the wing. Configuration effects were assessed for lift improvement devices, lift/cruise nozzle rails, nozzle perimeter plates, and alternate nose fan exit hubs. Tests were conducted at four model heights (H/D = 0.95, 1.53, 3.06 and 6.45, where D is the average nozzle exit diameter equal to 0.997 m.) Results are presented and discussed. A.R.H.

N80-16032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL/FLIGHT CORRELATION STUDY OF AERODYNAMIC CHARACTERISTICS OF A LARGE FLEXIBLE SUPERSONIC CRUISE AIRPLANE (XB-701) 2: EXTRAPOLATION OF WIND-TUNNEL DATA TO FULL-SCALE CONDITIONS
John B. Peterson, Jr., Michael J. Mann, Russell B. Sorrells, III, Wallace C. Sawyer, and Dennis E. Fuller Feb. 1980 80 p refs
(NASA-TP-1515; L-12688) Avail: NTIS HC A05/MF A01 CSCL 01A

The results of calculations necessary to extrapolate performance data on an XB-70-1 wind tunnel model to full scale at Mach numbers from 0.76 to 2.53 are presented. The extrapolation was part of a joint program to evaluate performance prediction techniques for large flexible supersonic airplanes similar to a supersonic transport. The extrapolation procedure included: interpolation of the wind tunnel data at the specific conditions of the flight test points; determination of the drag increments to be applied to the wind tunnel data, such as spillage drag, boundary layer trip drag, and skin friction increments; and estimates of the drag items not represented on the wind tunnel model, such as bypass doors, roughness, protuberances, and leakage drag. In addition, estimates of the effects of flexibility of the airplane were determined. J.M.S.

N80-16033*# McDonnell-Douglas Corp., St. Louis, Mo.
DEVELOPMENT OF PANEL METHODS FOR SUBSONIC ANALYSIS AND DESIGN Final Report
D. R. Bristow Feb. 1980 84 p refs
(Contract NAS1-15369)
(NASA-CR-3234) Avail: NTIS HC A05/MF A01 CSCL 01A

Two computer programs, developed for subsonic inviscid analysis and design are described. The first solves arbitrary mixed analysis design problems for multielement airfoils in two dimensional flow. The second calculates the pressure distribution for arbitrary lifting or nonlifting three dimensional configurations. In each program, inviscid flow is modelled by using distributed source doublet singularities on configuration surface panels. Numerical formulations and representative solutions are presented for the programs. A.W.H.

N80-16034# Naval Air Development Center, Warminster, Pa.
THE AERODYNAMICS OF A JET IN A CROSSFLOW Final Report
K. T. Yen 11 Dec. 1978 62 p refs
(AD-A076375; NADC-78291-60) Avail: NTIS HC A04/MF A01 CSCL 01/1

The aerodynamics of a jet in a crossflow considered as the key problem in transition aerodynamics for VSTOL aircraft were reviewed. Experimental results on the flow structure of the jet, the contrarotating vortices, the jet entrainment phenomenon, and the surface pressure distributions were analyzed. The influences on these characteristics by the jet parameters such as the velocity ratio, injection angle and jet orifice shape were considered based on available measurements. In the theoretical area, particular attention was directed to the methods of prediction and analysis, and the fundamental physical bases of these methods. Current developments in transition aerodynamics, and some recent work on the formation of contrarotating vortices and the wake flow are described. F.O.S.

N80-16035*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WING FLAPPING WITH MINIMUM ENERGY

R. T. Jones Jan. 1980 18 p refs
(NASA-TM-81174; A-8076) Avail: NTIS HC A02/MF A01 CSCL 01A

For slow flapping motions it is found that the minimum energy loss occurs when the vortex wake moves as a rigid surface that rotates about the wing root - a condition analogous to that determined for a slow-turning propeller. The optimum circulation distribution determined by this condition differs from the elliptic distribution, showing a greater concentration of lift toward the tips. It appears that very high propulsive efficiencies are obtained by flapping. Author

N80-16036*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A COMPARISON OF CALCULATED AND EXPERIMENTAL LIFT AND PRESSURE DISTRIBUTIONS FOR SEVERAL HELICOPTER ROTOR SECTIONS

John Conlon Jan. 1980 33 p refs
(NASA-TM-81160; A-8029) Avail: NTIS HC A03/MF A01 CSCL 01A

The use of computational techniques in predicting lift coefficients and pressure distributions of two dimenstional airfoil sections was studied. The computer code FL06/IBL was used to solve the compressible, two dimensional flow about four different airfoil sections. The lift coefficients of the airfoils were calculated at various angles of attack at subsonic Mach numbers and compared with experimental data. A.W.H.

N80-16037# Systems Research Labs., Inc., Newport News, Va. RASA Div.

SUMMARY OF THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF VORTEX LIFT AT HIGH ANGLES OF ATTACK Final Report, 1 Jan. 1974 - 31 Mar. 1979

D. S. JanakiRam, Satish S. Samant, and Richard P. White, Jr. May 1979 166 p refs
(Contract N00014-74-C-0091)
(AD-A074483; RASA/SRL-14-79-03; ONR-CR-212-223-5-F) Avail: NTIS HC A08/MF A01 CSCL 20/4

This summary report presents the development and verification of a theoretical prediction method for predicting aerodynamic characteristics of low aspect ratio and delta wings at high angles of attack. A summary of the experimental measurements made on low aspect ratio swept wings with leading edge vortex devices is presented as well as a discussion of the final computer program that was developed and correlated with experimental data obtained on swept and delta wings during the last year of the contract effort. GRA

N80-16043# National Aviation Facilities Experimental Center, Atlantic City, N. J.

AIR TRAFFIC CONTROL/FULL BEACON COLLISION AVOIDANCE SYSTEM, KNOXVILLE SIMULATION Final Report, Apr. - May 1978

B. Billmann, T. Morgan, R. Strack, and J. Windle Aug. 1979 47 p refs
(FAA Proj. 052-241-310)
(AD-A074555; FAA-RD-79-25) Avail: NTIS HC A03/MF A01 CSCL 17/7

The interaction between a full beacon collision avoidance system (BCAS) and the present air traffic control (ATC) system in a real-time simulation environment was investigated to determine the impact of BCAS on controllers and control procedures, the requirement of BCAS information to be displayed to the controller, and the effectiveness of alarm threshold desensitization in a terminal area. An additional objective was to evaluate the BCAS algorithm performance in terms of number, duration, and location of alerts and resolution effectiveness. Analysis of results indicates that the presence of BCAS in a moderate-density ATC terminal environment has no adverse effect on controllers or control procedures because of an extremely low positive command rate. A high number of BCAS advisory alerts which were displayed to aircraft but not to controllers had no effect on aircraft flightpaths. Many of these alerts were generated for aircraft navigating on established airways with proper ATC separation. A significant number of participating controllers favored the use of BCAS as a backup to the ATC system. A.R.H.

N80-16044# Lincoln Lab., Mass. Inst. of Tech., Lexington.

THE AIRCRAFT REPLY AND INTERFERENCE ENVIRONMENT SIMULATOR (ARIES). VOLUME 1: PRINCIPLES OF OPERATION

Michael Goon and David A. Spencer 22 Mar. 1979 268 p
(Contracts DOT-FA77WAI-261; F19628-78-C-0002; FAA Proj. 052-241-04)
(AD-A074542; FAA-RD-78-96; ATC-87-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 17/7

The operation of ARIES hardware and software is presented. Descriptive information, supported by block diagrams, simplified schematic diagrams and flow diagrams, is provided. M.M.M.

N80-16045# Lincoln Lab., Mass. Inst. of Tech., Lexington.

THE AIRCRAFT REPLY AND INTERFERENCE ENVIRONMENT SIMULATOR (ARIES). VOLUME 2: APPENDICES TO THE PRINCIPLES OF OPERATION

Michael Goon and David A. Spencer 22 Mar. 1979 112 p
(Contracts DOT-FA77WAI-261; F19628-78-C-0002; FAA Proj. 052-241-04)
(AD-A074482; FAA-RD-78-96; ATC-87-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 17/7

Articles are appended to provide: (1) explanations of design and programming aspects of the ARIES; (2) data format and data structure definitions; (3) detailed explanations of the meaning of ARIES error messages and an analysis of certain effects which may be expected when more than one ARIES simulators are interconnected to permit testing adjacent to DABS sensors. M.M.M.

N80-16046# Quanta Systems Corp., Rockville, Md.

OPTIMUM INTENSITY SETTING OF APPROACH AND RUNWAY LIGHT SYSTEMS Final Report, period ending 20 Aug. 1979

Charles A. Douglass 20 Aug. 1979 86 p refs
(Contracts DOT-FA77WAI-786; N68335-78-C-2022)
(AD-A075485; FAA-RD-79-87) Avail: NTIS HC A05/MF A01 CSCL 17/7

Criteria for determining the optimum intensity settings of approach and runway lights as a function of atmospheric transmissivity and/or meteorological visibility, were developed. In determining the optimum intensity settings, consideration was given to past practices, theoretical and experimental studies, and to the effects of the intensity setting on runway visual range. Changes in the present intensity setting criteria are recommended. J.M.S.

N80-16047# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Command and Control Div.

DIPOLE BROADSIDE GLIDE SLOPE ARRAY Final Report, Nov. 1973 - May 1979

R. S. Littlepage and R. Rajnic Washington DOT May 1979 94 p
(Contract DOT-FA74WA-3353)
(AD-A077042; FAA-RD-79-69) Avail: NTIS HC A05/MF A01 CSCL 09/5

The analysis and design, and the fabrication and test of an improved glide slope antenna system are presented. It is capable of providing CAT II performance over level ground, rising ground, and severe broken ground associated with problem sites. It is broadband and can operate at any ILS glide slop frequency with no special tuning. A monitoring technique was developed which is applicable to any antenna system consisting of a large number of radiators. The report contains the results of antenna range measurements and flight check data taken at a typical site. M.M.M.

N80-16048# National Aviation Facilities Experimental Center, Atlantic City, N. J.

TRANSPONDER PERFORMANCE ANALYZER (TPA) Final Report, Mar. 1976 - Mar. 1978

Carl Hazelwood Oct. 1979 33 p

(FAA Proj. 031-241-830)
(AD-A075783; FAA-RD-79-54; ANA-180) Avail: NTIS HC A03/MF A01 CSCL 17/7

The Transponder Performance Analyzer (TPA) used for measurement of aircraft beacon transponder performance characteristics is described. The system was developed at NAFEC utilizing both in-house designed and commercially available equipment. The system is fully self-supporting, is housed in a mobile bus, and has been used for ramp testing of transponders operating in general aviation aircraft and for bench testing of off-the shelf units. M.M.M.

N80-16049# Mitre Corp., McLean, Va. Metrek Div.
EVALUATION OF THE POTENTIAL FOR REDUCED LONGITUDINAL SPACING ON FINAL APPROACH
William J. Swedish Washington DOT Aug. 1979 126 p refs
(Contract DOT-FA79WA-4184)
(AD-A076434; FAA-EM-79-7; MTR-79W00280) Avail: NTIS HC A07/MF A01 CSCL 17/7

The feasibility of reduced IFR separation standards on final approach is addressed as well as the identification of the characteristics of the ATC system which affect or are affected by the separation standards. The conditions were limited to those times during which wake turbulence is not a factor. Given this assumption, separation reduction is limited by the need to avoid simultaneous runway occupancy by successive arrivals. Various technical improvements now under development may make it possible to operate a 2.0 nmi minimum with average runway occupancies as great as 45-50 seconds. Adequate communications and surveillance for the controller, and enforcement of current ATC procedures are also required for operations with reduced separations. An alternative solution to the runway occupancy problem is to use a pair of closespaced, dependent (dual-lane) runways and alternate arrivals between them. Reduced separation on approach to a single runway cannot be realized until the wake vortex problem is resolved. Although there do not appear to be any other technical or operational barriers to reduced separation standards, additional research is required before reduced standards can be implemented. M.M.M.

N80-16050# Federal Aviation Agency, Washington, D.C. Office of Systems Engineering Management.
REPORT OF THE FAA TASK FORCE ON AIRCRAFT SEPARATION ASSURANCE. VOLUME 1: EXECUTIVE SUMMARY
N. A. Blake Jan. 1979 37 p refs
(AD-A075352; AEM-2; FAA-EM-78-19-1-Rev-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

A task force developed FAA engineering and development consensus on the integrated aircraft separation assurance system for the National Airspace System is presented. A study of system errors, mid-airs, and near mid-airs to define the problem is described. The system element requirements are defined to provide two levels of backup to the air traffic control system: a separation violation warning and a final fail safe collision advisory and resolution function. R.E.S.

N80-16051*# Ohio Univ., Athens. Avionics Engineering Center.
RESULTS OF A LORAN-C FLIGHT TEST USING AN ABSOLUTE DATA REFERENCE
Joseph P. Fischer Jan. 1980 22 p refs
(Grant NGR-36-009-017)
(NASA-CR-162751; TM-74) Avail: NTIS HC A02/MF A01 CSCL 17G

A closed circuit flight test was conducted in the Boston area using VOR's and NDB's as reference points. The Loran-C data collected during the flight was then compared against a reference provided by the Discrete Address Beacon System (DABS) facility at Lincoln Laboratories. A MIT crew used a commercial receiver and recorded Loran-C time differences which would also be compared with the data provided by the DABS facility and eventually with the data collected by Ohio University. The Ohio University low-cost receiver was used for this test which was conducted in the Ohio University DC-3 flying laboratory. The Loran-C time-difference data was recorded with a microcomputer data collection system and stored on magnetic tape for subsequent analysis. The MIT receiver was also on board the DC-3, and recorded its data on a cassette tape which was later used by the MIT crew for data analysis. The equipment configuration in the aircraft, the flight procedure and the results obtained from the data collected with Ohio University's receiver and recording system are described. A.R.H.

N80-16053# National Technical Information Service, Springfield, Va.
COLLISION AVOIDANCE SYSTEMS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1979
Guy E. Habercom, Jr. Sep. 1979 391 p Supersedes NTIS/PS-78/0883; NTIS/PS-77/0765; NTIS/PS-76/0682; NTIS/PS-75/671; NTIS/PS-75/036
(NTIS/PS-79/0960/9; NTIS/PS-78/0883; NTIS/PS-77/0765; NTIS/PS-76/0682; NTIS/PS-75/671; NTIS/PS-75/036) Avail: NTIS HC $28.00/MF $28.00 CSCL 01B

Collision avoidance systems in three modes of transportation (i.e. air, surface, marine) are investigated. Traffic scheduling, automatic ground based stations, and on board warning systems for air transportation are discussed. The sensors and detectors relative to marine transportation collision avoidance are examined. Engineering research relative to highway and rail collision avoidance is reported. This bibliography contains 383 abstracts, 45 of which are new entries to the previous edition. GRA

N80-16054 Cincinnati Univ., Ohio.
PARAMETER IDENTIFICATION OF FLEXIBLE FLIGHT VEHICLES ASSUMING A LOW-REDUCED-FREQUENCY AERODYNAMIC REPRESENTATION Ph.D. Thesis
Robert Charles Schwanz 1979 184 p
Avail: Univ. Microfilms Order No. 8002138

The derivation and numerical demonstration of a recursive, sequential least squares method that may be used to identify the steady and unsteady aerodynamic parameters of a flexible vehicle from its flight test measurements is discussed. The state and measurement equations employed result from mathematical approximations of the vehicle dynamics developed using a state reduction procedure. The aerodynamics mathematical approximation considered is based upon a low reduced-frequency expansion of the potential flow equations. These approximations are most applicable to low aspect ratio flight vehicles operating at subsonic and supersonic speeds. It is demonstrated that the aerodynamic parameters may be estimated if the static aeroelastic measurement residual is employed to guide the reduction of state, the selection of control inputs, and the location of sensors. Dissert. Abstr.

N80-16055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEANS FOR CONTROLLING AERODYNAMICALLY INDUCED TWIST Patent Application
Wolf Elber, inventor (to NASA) Filed 28 Sep. 1979 10 p
(NASA-Case-LAR-12175-1; US-Patent-Appl-SN-079913) Avail: NTIS HC A02/MF A01 CSCL 01C

A wing twist deformation control mechanism which provides active compensation for aerodynamically induced twist deformation of high aspect ratio wings is described. The twist deformation control mechanism consists of a torque tube, internal to each wing and rigidly attached near the tip of each wing, and an actuator located in the aircraft fuselage. As changes in the aerodynamic loads on the wings occur, the torque tube is rotated to compensate for the induced wing twist. NASA

N80-16056# Kaman Avidyne, Burlington, Mass.
AN EVALUATION OF THE ADINA FINITE ELEMENT PROGRAM FOR APPLICATION TO AIRCRAFT OVERPRESSURE VULNERABILITY Final Report, 12 Nov. 1977 - 31 Oct. 1978
Thomas R. Stagliano and Lawrence J. Mente Feb. 1979 80 p refs

(Contract DNA001-78-C-0057)
(AD-A074261; AD-E300579; KA-TR-162; DNA-4876F) Avail: NTIS HC A05/MF A01 CSCL 01/3

In aircraft overpressure vulnerability, stiffened thin-walled panel configurations are subjected to surface pressure loadings of varying time histories. These dynamic loads subject the impinged structural components to large deflections and an elastic-plastic material response. The ability to predict accurately the deflection and strain time histories of complex aircraft structures of arbitrary geometry has become of increasing importance. The ADINA (Automatic Dynamic Incremental Nonlinear Analysis) computer code is evaluated to determine if it is a numerically accurate, computationally efficient means of analyzing these complex structures under transient pressure loading. In this initial evaluation, the ADINA solutions for clamped beams, simply supported, and clamped flat unstiffened panels and flat stiffened panels subjected to transient pressure loadings are compared with solutions from other nonlinear structural codes. ADINA was found to be an efficient and accurate computer code which provides the full nonlinear capability required for aircraft vulnerability analysis. Shortly, a new version of ADINA will be available that contains a desirable thin shell element. However, ADINA finite elements would still have to be extended to include various shaped stringer and frame cross sections and multilayered skin configurations associated with aircraft structures. GRA

N80-16057# New Mexico Univ., Albuquerque.
TECHNOLOGICAL FORECASTING-AIRCRAFT DESIGN. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Aug. 1979
Gerald F. Zollars Oct. 1979 32 p Sponsored by NTIS
(NTIS/PS-79/1017/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Citations to the international literature of technological forecasts of aircraft design changes are reported. Forecasts dealing with the configuration of both civil and military aircraft are included. Specific topics stressed are fuel consumption, avionics, and cost and noise reduction. (Contains 110 citations). GRA

N80-16059# National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
TITANIUM COMBUSTION IN TURBINE ENGINES Final Report
Thomas R. Strobridge, John C. Moulder, and Alan F. Clark Washington DOT Jul. 1979 131 p refs
(Contract DOT-FA78WAI-831)
(AD-A075657; NBSIR-79-1616; FAA-RD-79-51) Avail: NTIS HC A07/MF A01 CSCL 11/6

Pure and alloyed titanium components are routinely used in aircraft turbine engines because of their uniquely high strength-to-weight ratios among structural metals, combined with excellent fatigue and corrosion resistance. Like most other metals, titanium is combustile under certain conditions of temperature, pressure and oxygen concentration and in fact there have been several instances of titanium combustion in service engines. Contemporary titanium use in aircraft turbine engines and the limits of that use are explored. Combustivn incidents and their causes are discussed as well as the typical extent of damage. Current preventative measures are outlined. For better understanding, the fundamentals of metal combustion and the experimental research related to titanium combustion are thoroughly treated and analytical combustion models are presented. Finally, the relevant experimental combustion data are correlated as a function of static temperature and Reynolds number and compared to the model predictions. Author

N80-16060*# Massachusetts Inst. of Tech., Cambridge.
AIR POLLUTION FROM AIRCRAFT
John B. Heywood, James A. Fay, and Norman A. Chigier (Sheffield Univ.) Oct. 1979 47 p refs
(Grant NGR-22-009-378)
(NASA-CR-159712) Avail: NTIS HC A03/MF A01 CSCL 21E

A series of fundamental problems related to jet engine air pollution and combustion were examined. These include soot formation and oxidation, nitric oxide and carbon monoxide emissions mechanisms, pollutant dispension, flow and combustion characteristics of the NASA swirl can combustor, fuel atomization and fuel-air mixing processes, fuel spray drop velocity and size measurement, ignition and blowout. A summary of this work, and a bibliography of 41 theses and publications which describe this work, with abstracts, is included. A.R.H.

N80-16061*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE NOISE INVESTIGATION OF THE CF6-50 TURBOFAN ENGINE Data Report, 1978 - 1979
V. L. Doyle Jan. 1980 357 p
(Contract NAS3-21260)
(NASA-CR-159598; R79AEG247) Avail: NTIS HC A16/MF A01 CSCL 21E

Acoustic data obtained during the running of the CF6-50 turbofan engine on an outdoor test stand are presented. The test was conducted to acquire simultaneous internal and far-field measurements to determine the influence of internally generated noise on the far-field measurements. The data includes internal and far-field narrowband and one-third octave band pressure spectra. R.E.S.

N80-16062*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CORE NOISE INVESTIGATION OF THE CF6-50 TURBOFAN ENGINE Final Report
V. L. Doyle and M. T. Moore Jan. 1980 520 p refs
(Contract NAS3-21260)
(NASA-CR-159749; R79AEG395) Avail: NTIS HC A22/MF A01 CSCL 21E

The contribution of the standard production annular combustor to the far-field noise signature of the CF6-50 engine was investigated. Internal source locations were studied. Transfer functions were determined for selected pairs of combustor sensors and from two internal sensors to the air field. The coherent output power was determined in the far-field measurements, and comparisons of measured overall power level were made with component and engine correlating parameters. R.E.S.

N80-16063*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
EXPANDED STUDY OF FEASIBILITY OF MEASURING IN-FLIGHT 747/JT9D LOADS, PERFORMANCE, CLEARANCE, AND THERMAL DATA
G. P. Sallee and R. L. Martin (Boeing Commercial Airplane Co., Seattle, Wash.) 4 Feb. 1980 107 p
(Contract NAS3-20632)
(NASA-CR-159717; PWA-5512-46) Avail: NTIS HC A06/MF A01 CSCL 21E

The JT9D jet engine exhibits a TSFC loss of about 1 percent in the initial 50 flight cycles of a new engine. These early losses are caused by seal-wear induced opening of running clearances in the engine gas path. The causes of this seal wear have been identified as flight induced loads which deflect the engine cases and rotors, causing the rotating blades to rub against the seal surfaces, producing permanent clearance changes. The real level of flight loads encountered during airplane acceptance testing and revenue service and the engine's response in the dynamic flight environment were investigated. The feasibility of direct measurement of these flight loads and their effects by concurrent measurement of 747/JT9D propulsion system aerodynamic and inertia loads and the critical engine clearance and performance changes during 747 flight and ground operations was evaluated. A number of technical options were examined in relation to the total estimated program cost to facilitate selection of the most cost effective option. It is concluded that a flight test program meeting the overall objective of determining the levels of aerodynamic and inertia load levels to which the engine is exposed

during the initial flight acceptance test and normal flight maneuvers is feasible and desirable. A specific recommended flight test program, based on the evaluation of cost effectiveness, is defined. A.R.H.

N80-16064# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.
RESEARCH ON THE FLUTTER OF AXIAL TURBOMACHINE BLADING
Fernando Sisto and Mark Ward Sep. 1979 41 p refs
(Contract N00014-76-C-0540; NR Proj. 094-363)
(AD-A074597; ME-RT-79004) Avail: NTIS HC A03/MF A01 CSCL 20/4

Typical aerodynamic moment and free flutter measurements are presented for negative stagger of thin airfoils in an annular cascade. The parameters of interest for the free flutter measurements are incidence angle, torsional amplitude, and reduced frequency (reduced velocity). For moment measurements, the significant parameters are mean incidence angle, interblade phase angle, and amplitude of oscillation. Since measurements take the form of a continuous record of moment versus angular position, the symbolic name 'moment loops' is used. The characteristics of the experimental data are discussed and comparison is made with earlier test data for positive stagger angle with the same airfoil. GRA

N80-16065*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DIGITAL ADAPTIVE CONTROLLERS FOR VTOL VEHICLES. VOLUME 1: CONCEPT EVALUATION Final Report
G. L. Hartmann, Gunter Stein, and Stephen G. Pratt Nov. 1979 196 p refs 2 Vol.
(Contract NAS1-14921)
(NASA-CR-159154-Vol-1; HONEYWELL-2825-41592-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 01C

A digital self-adaptive flight control system was developed for flight test in the VTOL approach and landing technology (VALT) research aircraft (a modified CH-47 helicopter). The control laws accept commands from an automatic on-board guidance system. The primary objective of the control laws is to provide good command-following with a minimum cross-axis response. Three attitudes and vertical velocity are separately commanded. Adaptation of the control laws is based on information from rate and attitude gyros and a vertical velocity measurement. The final design resulted from a comparison of two different adaptive concepts--one based on explicit parameter estimates from a real-time maximum-likelihood estimation algorithm, the other based on an implicit model reference adaptive system. The two designs were compared on the basis of performance and complexity. A.R.H.

N80-16066*# Honeywell, Inc., Minneapolis, Minn.
DIGITAL ADAPTIVE CONTROLLERS FOR VTOL VEHICLES. VOLUME 2: SOFTWARE DOCUMENTATION Final Report
G. L. Hartman, Gunter Stein, and Stephen G. Pratt Nov. 1979 90 p 2 Vol.
(Contract NAS1-14921)
(NASA-CR-159154-Vol-2; HONEYWELL-2825-41592-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 01C

The VTOL approach and landing test (VALT) adaptive software is documented. Two self-adaptive algorithms, one based on an implicit model reference design and the other on an explicit parameter estimation technique were evaluated. The organization of the software, user options, and a nominal set of input data are presented along with a flow chart and program listing of each algorithm. A.R.H.

N80-16067# Braslau (David) Associates, Inc., Minneapolis, Minn.
GROUND RUN-UP NOISE CONTROL FACILITIES FOR CIVIL AIRCRAFT: A SURVEY
David Braslau 30 Jan. 1979 123 p
(Contract W1-78-5339-1)
(AD-A075348; FAA-RD-79-17; ARD-410) Avail: NTIS HC A06/MF A01 CSCL 01/4

This survey of existing ground run-up suppressors and barriers for civil aircraft includes a review of acoustical, aerodynamic, and mechanical effects associated with facilities in the United States, Europe, and Japan. Evaluations were made of each suppressor based upon published and unpublished reports, and supplemented where necessary by direct questionnaires to the operators, designers, and users of the facilities. Acoustical data where available was compiled for near and far field points at all directions from aircraft heading. Aerodynamic and mechanical effects on airframe and engine performance during run-up have been identified in terms of exhaust gas reingestion, engine or airframe damage, or restrictions on facility operation. The potential for standards development is discussed with respect to available information with recommendations for additional studies needed before such standards could be promulgated. M.M.M.

N80-16068*# Washington Univ., Seattle.
RECENT RESEARCH ON V/STOL TEST LIMITS AT THE UNIVERSITY OF WASHINGTON AERONAUTICAL LABORATORY Final Report
Shojiro Shindo and William H. Rae, Jr. Feb. 1980 27 p refs
(Grant NGL-48-002-035)
(NASA-CR-3237) Avail: NTIS HC A03/MF A01 CSCL 14B

The occurence of flow breakdown during the wind tunnel testing of a powered V/STOL aircraft was studied. Flow breakdown is the low forward speed test limit in a solid wall wind tunnel and is characterized by a vortex which forms on the floor and walls of the wind tunnel thereby failing to simulate free air conditions. The flow is caused by the interaction of the model wake and tunnel boundary layer and affects the model's aerodynamic characteristics in such fashion as to negate their reliability as correctable wind tunnel data. The low speed test limit was examined using a model that possessed a discretely concentrated powered lift system using a pair of lift jets. The system design is discussed and the tests and results which show that flow breakdown occurs at a velocity ratio of approximately 0.20 are reported. A.W.H.

N80-16069# BDM Corp., McLean, Va. Systems Research and Development Service.
INFRARED RUNWAY COLLISION AVOIDANCE SYSTEM ANALYSIS Final Report, Sep. 1978 - Mar. 1979
P. E. Powell and G. H. Greenleaf Apr. 1979 87 p refs
(Contract DOT-FA78WA-4196)
(AD-A078131; FAA-RD-79-32; BDM/W-79-099-TR) Avail: NTIS HC A05/MF A01 CSCL 01/5

The applicability and effectiveness of active and passive infrared devices for use in runway collision avoidance systems during low visibility airport operations are addressed. Emphasis is placed on the optical attenuation caused by conditions of fog and haze as a function of detector system wavelength. Two feasible approaches to the use of infrared techniques in runway collision avoidance systems are presented. The recommended approach involves the use of a runway-mounted active CO2 laser system which provides an unambiguous indication of aircraft on the runway. The CO2 laser application has several desirable characteristics which include required all weather conditions. The alternative approach involves the use of a runway-mounted two-color passive IR system for jet engine heat detection. The two-color system is feasible but falls short of providing satisfactory detection range in fog without excessive hardware deployment. The recommended approach to development of a system specification which would include experimental tests and design of a prototype system is discussed. J.M.S.

N80-16070*# Franklin Inst. Research Labs., Philadelphia, Pa.
FEASIBILITY AND CONCEPT STUDY TO CONVERT THE NASA/AMES VERTICAL MOTION SIMULATOR TO A HELICOPTER SIMULATOR Final Report
C. A. Belsterling, R. C. Chou, E. G. Davies, and K. C. Tsui Sep. 1978 150 p
(Contract NAS2-9884; NASA Order C-4952-1)
(NASA-CR-152193) Avail: NTIS HC A07/MF A01 CSCL 14B

The conceptual design for converting the vertical motion simulatior (VMS) to a multi-purpose aircraft and helicopter

simulator is presented. A unique, high performance four degrees of freedom (DOF) motion system was developed to permanently replace the present six DOF synergistic system. The new four DOF system has the following outstanding features: (1) will integrate with the two large VMS translational modes and their associated subsystems; (2) can be converted from helicopter to fixed-wing aircraft simulation through software changes only; (3) interfaces with an advanced cab/visual display system of large dimensions; (4) makes maximum use of proven techniques, convenient materials and off-the-shelf components; (5) will operate within the existing building envelope without modifications; (6) can be built within the specified weight limit and avoid compromising VMS performance; (7) provides maximum performance with a minimum of power consumption; (8) simple design minimizes coupling between motions and maximizes reliability; and (9) can be built within existing budgetary figures. R.E.S.

N80-16071*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN CONSIDERATIONS FOR ATTAINING 200-KNOT TEST VELOCITIES AT THE AIRCRAFT LANDING LOADS AND TRACTION FACILITY
Gary L. Giles and Sandy M. Stubbs May 1979 75 p refs
(NASA-TM-80096) Avail: NTIS HC A04/MF A01 CSCL 14B

Design studies are presented which consider the important parameters in providing 200 knot test velocities at the landing loads and traction facility. Two major components of this facility, the hydraulic jet catapult and the test carriage structure, are considered. Suitable factors are determined to correlate analytical data for characteristics of the hydraulic jet catapult with data measured from the existing catapult system. The resulting equations are used to calculate test velocities for a range of jet nozzle diameters and carriage masses with both the current 122 m and an increased 183 m catapult stroke. Using the catapult characteristics, a target design point is selected and a carriage structure is sized to meet the target point strength requirements. A.W.H.

N80-16091*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER LANDING LOADS MATH MODEL DESCRIPTION AND CORRELATION WITH ALT FLIGHT DATA
David A. Hamilton, John A. Schliesing, and George A. Zupp, Jr. Washington Jan. 1980 27 p refs
(NASA-RP-1056; JSC-16202; S-498) Avail: NTIS HC A03/MF A01 CSCL 22B

Results of the space shuttle approach and landing test are examined in order to assess landing gear characteristics and performance and verify landing dynamic analyses. The landing gears were instrumented with load-calibrated strain gages, a wheel-speed sensor, and strut stroke measurement devices. The mathematical procedure used in predicting the shuttle touchdown loads and dynamics is presented together with the comparisons between measured flight data and the analytical predictions. Conclusions from these data are also presented. J.M.S.

N80-16100*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NOVEL APPROACHES FOR ALLEVIATION OF ELECTRICAL HAZARDS OF GRAPHITE-FIBER COMPOSITES
Kumar Ramohalli 15 Oct. 1979 47 p refs
(Contract NAS7-100)
(NASA-CR-162683; JPL-Pub-79-63) Avail: NTIS HC A03/MF A01 CSCL 11D

Four basically different approaches were considered: gasification of fibers, retention in the matrix, clumping to prevent entrainment, and electrical insulation of fibers. The techniques used to achieve them are described in some detail. These involved surface treatment of fibers to improve the wettability of fibers and coating the fibers with the selected substances before laying them up for composite fabrication. Thermogravimetric analyses were performed on the plain and treated fibers in inert (nitrogen, argon) and reactive (air) atmospheres. The treated fibers embedded in epoxy were ignited in a Bunsen flame to determine the efficiency of these treatments. A simple apparatus was assembled to detect the time for the first short circuit (in a typical electrical circuit) when exposed to the combustion products from a graphite fiber composite fire. The state-of-the-art and treated fibers cast in typical epoxy were burned and ranked for potential success. It was inferred that the gasification schemes appear promising when reduction or oxidation is tried. It was also found that some very promising candidates were available for the clumping and for the electrical insulation of fibers. A.R.H.

N80-16104*# National Aeronautics and Space Administration, Washington, D. C.
COMPOSITE COMPONENTS UNDER IMPACT LOAD AND EFFECTS OF DEFECTS ON THE LOADING CAPACITY
R. Aoki and D. Wurzel Sep. 1979 47 p Transl. into ENGLISH of conf. paper "Composite-bautseileunter Schlagbelastung und Auswirkung von Defekten auf die Belastbarkeit", DGLR-78-190 DGLR, West Germany, 1978 48 p Presented at the DGLR Symp. Fatigue Strength of Airplanes and Mod. Construct. Tech., Darmstadt, West Germany, 22 Sep. 1978 Original language document announced as A79-20491 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75351; DGLR-78-190) Avail: NTIS HC A03/MF A01 CSCL 11D

Investigations were carried out on a horizontal tail assembly made of carbon fiber reinforced plastic for the Alpha Jet. The possibility of obtaining a leading edge nose design lighter but not more expensive than a metal version was studied. An important consideration was sufficient resistance of the leading edge against impact of stones and hailstones combined with high degree of stiffness. The improvement of energy reception characteristics of the materials through suitable laminate design was considered. Since certain defects occur in structural components, the effects of such defects on the characteristics of the parts were also studied. K.L.

N80-16143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME CONSIDERATIONS OF THE PERFORMANCE OF TWO HONEYCOMB GAS PATH SEAL MATERIAL SYSTEMS
Robert C. Bill and Lawrence T. Shiembob 1980 29 p refs To be presented at the Ann. Meeting of the Am. Soc. of Lubrication Engr., Anaheim, Calif., 5-8 May 1980 Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, and Pratt and Whitney Aircraft Group, East Hartford, Conn.
(NASA-TM-81398; AVRACOM-TR-79-33; E-032) Avail: NTIS HC A03/MF A01 CSCL 11F

A standard Hastelloy-X honeycomb material and a pack aluminide coated honeycomb material were evaluated as to their performance as labyrinth seal materials for aircraft gas turbine engines. Consideration from published literature was given to the fluid sealing characteristics of two honeycomb materials in labyrinth seal applications, and their rub characteristics, erosion resistance, and oxidation resistance were evaluated. The increased temperature potential of the coated honeycomb material compared to the uncoated standard could be achieved without compromising the honeycomb material's rub tolerance, although there was some penalty in terms of reduced erosion resistance. Author

N80-16152# Metal Properties Council, Inc., New York.
DEVELOPMENT OF A STANDARD METHODOLOGY FOR THE CORRELATION AND EXTRAPOLATION OF ELEVATED TEMPERATURE CREEP AND RUPTURE DATA. VOLUME 2: A STATE-OF-THE-ART REVIEW Final Report
R. M. Goldhoff Apr. 1979 381 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 638-1)
(EPRI-FP-1062-Vol-2) Avail: NTIS HC A17/MF A01

Contents: (1) The evaluation of elevated temperature creep and rupture strength data: an historical perspective; (2) pre-analy-

sis assessment of creep-rupture data; (3) a comprehensive method of rupture data analysis with simplified models; (4) status of the minimum-commitment method for creep-rupture applications; and (5) regression analysis of creep-rupture data-a practical approach. A.R.H.

N80-16197# Naval Construction Battalion Center, Port Hueneme, Calif. Civil Engineering Lab.
SHRINKAGE-COMPENSATING CEMENT FOR AIRPORT PAVEMENT, PHASE 2
John R. Keeton Sep. 1979 42 p refs
(Contract DOT-FA75WAI-530)
(AD-A075739; FAA-RD-79-11; TN-1561) Avail: NTIS HC A03/MF A01 CSCL 11/2

Details of a research study on shrinkage-compensating concrete for airport pavements are presented. A total of 53 slab-type prisms 1 foot square and 8, 12, 16, or 20 inches thick were subjected to shrinkage, cooling, and heating. Concrete compressive stresses induced by expansion were calculated, as well as residual compressive stresses after losses due to shrinkage and cooling. The residual concrete compressive stresses, coupled with results from previous field applications of shrinkage-compensating concrete, are used as a basis for recommendation of transverse joint spacings up to 200 feet. Author

N80-16202*# Rockwell International Corp., El Segundo, Calif.
STATUS OF CAVITY NOISE PHENOMENA MEASUREMENT AND SUPPRESSION ON THE B-1 AIRCRAFT
A. G. Tipton and C. H. Hodson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt 1 Sep. 1979 p 59-66 refs
Avail: NTIS HC A09/MF A01 CSCL 20A

During the B-1 aircraft development, an extensive program of weapons bay cavity noise measurement and suppression studies was performed using wind tunnel models, flight test measurements, and aircraft design modifications. Substantial cavity noise reduction was demonstrated during flight test operations. The unsuppressed cavity noise level of 170 dB was reduced to values less than 150 dB with external retractable spoilers upstream of the cavity opening. J.M.S.

N80-16226*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
APPLICATION OF RANDOM TIME DOMAIN ANALYSIS TO DYNAMIC FLIGHT MEASUREMENTS
S. R. Ibrahim *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1979 p 165-170 refs
(Grant NsG-1459)
Avail: NTIS HC A10/MF A01 CSCL 01C

An approach is presented for modal identification of aerospace structures from flight measurements. This approach is the result of combining the time domain modal identification technique and the multiple channel random decrement technique. A technique is also presented to determine relative levels of excitation for identified modes. These techniques are applied to flight data taken from the B-1 bomber. Results are extremely encouraging. Author

N80-16233# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
ACCURACY OF HYDROFOIL LOADING PREDICTIONS OBTAINED FROM A LIFTING-SURFACE COMPUTER PROGRAM Final Report
Peter K. Besch and Edwin P. Rood, Jr. Sep. 1979 203 p refs
(ZF4342101)
(AD-A074702; DTNSRDC-79/039) Avail: NTIS HC A10/MF A01 CSCL 13/10

To provide guidance for hydrofoil designers, an extensive operational evaluation was made of a computer-based lifting-surface theory for calculating hydrodynamic loading on hydrofoils in steady and unsteady motion in inviscid, subcavitating flow at finite depth. Both the numerical stability and the accuracy in comparison with model data were estimated. By use of an empirical correction, lift predictions can be made with an accuracy of about 15 to 20 percent, while pitching moment predictions are substantially less accurate. Determination of the accuracy was hindered by insufficient or imprecise data. Documentation for the computer program is given. Author (GRA)

N80-16234# Aerojet Liquid Rocket Co., Sacramento, Calif.
JEFF(A) MIXED-FLOW MODEL FAN PERFORMANCE OPTIMIZATION Final Report
S. A. Lorenc Jun. 1979 120 p refs
(Contract N00014-78-C-0441)
(AD-A074571; ALRC-FD9630-001) Avail: NTIS HC A06/MF A01 CSCL 13/10

This model test program was conducted in order to improve the performance of the JEFF(A) Mixed-Flow Fan. Both rotor and housing changes were made to the existing model fan and tests were conducted in the ALRC Physics Laboratory. Rotor modifications consisted of varying blade length and narrowing the rotor width at the exit. Housing size was varied by changing axial and radial dimensions. The sensitivity of fan performance to IGV positioning was also determined for both flat and twisted vanes. Finally, full size fan performance was predicted for the best combination of housing and rotor. Recommendations are also made for further improvement of the Mixed-Flow Fan concept. GRA

N80-16236# Los Alamos Scientific Lab., N. Mex. Cryogenics Group.
SAFETY OF LIQUID HYDROGEN IN AIR TRANSPORTATION
F. J. Edeskuty 1979 18 p refs Presented at the Hydrogen in Air Transportation Conf., Stuttgart, 10 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1416; CONF-790942-1) Avail: NTIS HC A02/MF A01

The safety factors and problems associated with the use of liquid hydrogen as an aircraft fuel are discussed. The properties of liquid hydrogen are reviewed and their effect upon airline operations is reported. The effects include safety requirements for storage and refueling systems and safety devices for aircraft hangars and buildings in the close vicinity. Safety problems which need further research are addressed. These include the consequences of a hydrogen spill and dispersion, hydrogen combustion, and hydrogen disposal.

N80-16259# Rome Air Development Center, Griffiss AFB, N.Y.
FAA LIGHTNING PROTECTION STUDY: REPORT OF INVESTIGATIONS RELATIVE TO PROVIDING LIGHTNING PROTECTION FOR THE REMOTE CENTER AIR-TO-GROUND (RCAG)
Richard M. Cosel May 1979 13 p refs
(Contract DOT-FA72WAI-356)
(AD-A076943; FAA-RD-79-102) Avail: NTIS HC A02/MF A01 CSCL 17/2

The susceptibility of FAA electronic systems to induced electromagnetic pulse effects due to lightning is considered. Protective devices adequate for low voltage solid state systems are proposed. The Remote Center Air to Ground system is presented. While the RCAG does contain solid state circuitry with potentially susceptible components, they are sufficiently isolated from transients so that effects are apparently negligible. Two separate reviews of four RCAG's in Florida failed to surface any outages directly attributable to lightning induced transients on control lines. M.M.M.

N80-16296*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
NONPARALLEL STABILITY OF THREE-DIMENSIONAL COMPRESSIBLE BOUNDARY LAYERS. PART 1: STABILITY

ANALYSIS Final Report
Nabil M. El-Hady Feb. 1980 38 p refs
(Grant NsG-1645)
(NASA-CR-3245) Avail: NTIS HC A03/MF A01 CSCL 20D

A compressible linear stability theory is presented for nonparallel three-dimensional boundary-layer flows, taking into account the normal velocity component as well as the streamwise and spanwise variations of the basic flow. The method of multiple scales is used to account for the nonparallelism of the basic flow, and equations are derived for the spatial evolution of the disturbance amplitude and wavenumber. The numerical procedure for obtaining the solution of the nonparallel problem is outlined. Author

N80-16300*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TURBULENCE MEASUREMENTS IN THE BOUNDARY LAYER OF A LOW-SPEED WIND TUNNEL USING LASER VELOCIMETRY
Edward T. Schairer Feb. 1980 25 p refs
(NASA-TM-81165; A-8058) Avail: NTIS HC A02/MF A01 CSCL 20D

Laser velocimeter measurements in an incompressible, turbulent boundary layer along the wall of a low-speed wind tunnel are presented. The laser data are compared with existing hot-wire anemometer measurements of a flat plate, incompressible, turbulent, boundary layer with zero pressure gradient. An argument is presented to explain why previous laser velocimeter measurements in zero pressure gradient, turbulent boundary layers have shown an unexpected decrease in turbulent shear stresses near the wall. M.M.M.

N80-16318# National Technical Information Service, Springfield, Va.
HOT FILM ANEMOMETRY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979
Guy E. Habercom, Jr. Sep. 1979 63 p Supersedes NTIS/PS-78/0879; NTIS/PS-77/0783; NTIS/PS-76/0731; NTIS/PS-75/664
(NTIS/PS-79/0909/6; NTIS/PS-78/0879; NTIS/PS-77/0783; NTIS/PS-76/0731; NTIS/PS-75/664) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

The principles of hot film anemometer operation are summarized. Wind tunnel and laboratory tests are described. Flow field dynamics are discussed involving turbulence, boundary layers, separation, shock waves, and stresses. Mathematical models and analysis are presented along with computer techniques and a number of applications. GRA

N80-16575*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF AIRCRAFT RESULTS FOR 1978 SOUTHEASTERN VIRGINIA URBAN PLUME MEASUREMENT STUDY OF OZONE, NITROGEN OXIDES, AND METHANE
Gerald L. Gregory, Dewey E. Wornom, Joe J. Mathis, Jr., and Daniel I. Sebacher Washington Feb. 1980 222 p refs
(NASA-TM-80146; L-12981) Avail: NTIS HC A10/MF A01 CSCL 13B

Ozone production was determined from aircraft and surface in situ measurements, as well as from an airborne laser absorption spectrometer. Three aircraft and approximately 10 surface stations provided air-quality data. Extensive meteorological, mixing-layer-height, and ozone-precursor data were also measured. Approximately 50 hrs (9 flight days) of data from the aircraft equipped to monitor ozone, nitrogen oxides, dewpoint temperature, and temperature are presented. In addition, each experiment conducted is discussed. A.R.H.

N80-16577*# Columbia Univ., New York.
RESEARCH PLAN FOR ESTABLISHING THE EFFECTS OF TIME VARYING NOISE EXPOSURES ON COMMUNITY ANNOYANCE AND ACCEPTABILITY
Paul N. Borsky Jan. 1980 99 p refs
(Grant NsG-1616)
(NASA-CR-159197) Avail: NTIS HC A05/MF A01 CSCL 13B

The design of a community noise survey to determine the effects of time varying noise exposures in residential communities is presented. Complex physical and human variables involved in the health and welfare effects of environmental noise and the number-level tradeoffs and time of day penalties are among the factors considered. Emphasis is placed on community reactions where noise exposures are equal in day or evening but differ in the night time, and the effects of ambient noise on more intense aircraft noise exposures. Thirteen different times of day and types of operation situations with exposed populations up to 8-10 miles from the airport are identified. A detailed personal interview questionnaire as well as specific instructions to interviewers are included. J.M.S.

N80-16676*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
THE ROLE OF SATELLITE ALTIMETRY IN CLIMATE STUDIES
C. L. Parsons Washington Jan. 1980 32 p refs
(NASA-TP-1570) Avail. NTIS HC A03/MF A01 CSCL 04B

The results of three generations of satellite-borne radar altimetry experiments are summarized. The diverse measurements possible from this instrument are shown to be directly applicable to studies of the importance of the oceans in climate. The radar altimeter has unique value for investigations seeking knowledge of the interconnections between ocean dynamics, heat and momentum transfer across the air-sea interface, sea ice extent, and polar ice sheet thickness. Author

N80-16839*# Systems Research Labs., Inc., Newport News, Va. RADA Div.
EXPERIMENTAL EVALUATION OF ACTIVE AND PASSIVE MEANS OF ALLEVIATING ROTOR IMPULSIVE NOISE IN DESCENT FLIGHT
D. S. Janakiram Nov. 1979 86 p refs
(Contract NAS1-15337)
(NASA-CR-159188; RASA/SRL-14-79-04) Avail: NTIS HC A05/MF A01 CSCL 20A

A controlled wind tunnel test program was conducted on a model 2.14 m (7 ft) diameter teetering rotor to determine the effectiveness of blade tips such as the Ogee tip and the TAMI (Tip Air Mass Injection) tip in reducing the impulsive noise due to blade-vortex interaction in descent flight. In addition, a full rectangular tip which has the same span as the Ogee tip and an effective rectangular tip which has the same lifting area as the Ogee tip were also considered. The tests were conducted at two advance ratios (0.125 and 0.14) with various descent rates ranging from steady level flight to about 6 m/sec (20 ft/sec). A comparison of the performance of different rotors showed that for the same tip, Mach number and thrust, the Ogee tip rotor absorbed more power than the full rectangular tip rotor, while the TAMI tip rotor absorbed more power than the effective tip rotor. M.M.M.

N80-17014*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FISCAL YEAR 1979 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS AND PRESENTATIONS
O. L. White, comp. Oct. 1979 62 p
(NASA-TM-78250) Avail: NTIS HC A04/MF A01 CSCL 05B

This bibliography lists approximately 590 formal NASA technical reports, papers published in technical journals, presentations by MSFC personnel, and reports of MSFC contractors introduced into the NASA scientific and technical information system in 1979. J.M.S.

N80-17022# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept.
COMPILATION OF DATA COVERING AIRCRAFT SERVICING FACILITIES ABOARD AVIATION AND AMPHIBIOUS AVIATION SHIPS
Michael A. Strano 17 Oct. 1979 279 p
(AD-A076443; NAEC-ENG-6703-Rev-15) Avail: NTIS HC A13/MF A01 CSCL 01/3

This report is a compilation of data covering aircraft servicing facilities aboard aviation and amphibious aviation ships. Data is furnished on aircraft servicing facilities relating to fueling and defueling, electrical starting and servicing, oxygen and nitrogen, aircraft inertial alignment, compressed air, and cooling and starting air. GRA

N80-17032# ARO, Inc., Arnold Air Force Station, Tenn.
SEPARATED AND NONSEPARATED TURBULENT FLOWS ABOUT AXISYMMETRIC NOZZLE AFTERBODIES. PART 1: DETAILED SURFACE MEASUREMENTS Final Report, 1 Oct. 1976 - 30 Sep. 1977
J. A. Benek AEDC Oct. 1979 51 p refs
(AD-A077144; AEDC-TR-78-49-PT-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

Extensive static pressure data were obtained on a model consisting of a cone-ogive-cylinder forebody, two interchangeable circular arc afterbody boattails having length-to-forebody diameter ratios of 0.80 and 1.77, and two interchangeable solid exhaust plume simulators of cylindrical and contoured geometry. Boundary-layer pitot data and photographic records of model tufts and schlieren data were also obtained. Data were collected over a Mach number range of 0.60 to 1.30 and a unit Reynolds number range of 3.2 to 13.12 million per m (1 to 4 million per ft) at zero angle of attack and sideslip for the purpose of obtaining experimental data suitable for comparison with theoretical predictions. Data are presented for two model configurations with cylindrical solid plume simulators at three flow conditions: (1) length-to-diameter ratio = 1.77 boattail at Mach number 0.80 and Reynolds number 8.2 million per m for high subsonic, unseparated flow; (2) length-to-diameter ratio = 0.80 boattail at Mach number 0.60 and unit Reynolds number 8.2 million per m for subsonic, separated flow; and (3) length-to-diameter ratio = 0.80 boattail at Mach number 0.95 and unit Reynolds number 8.2 million per m for transonic, separated flow with boundary-layer-shock interaction. GRA

N80-17033# McDonnell-Douglas Research Labs., St. Louis, Mo.
UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER Annual Technical Report, 1 Apr. 1978 - 31 Mar. 1979
M. Sajben and J. C. Kroutil 31 May 1979 27 p refs
(Contract F49620-77-C-0082; AF Proj. 2307)
(AD-A075261; AFOSR-79-0990TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The second and third years of the contract comprise its second phase, aimed at exploring the effects of periodic, downstream excitation on the transonic flow in a two-dimensional diffuser model. The present report covers the second year of the contract. The pulse generator was incorporated in the diffuser model, and its controls were synchronized with the optical instrumentation. The boundary-layer control system was turned for best two-dimensionality of the flow. The flowfield instrumentation was selected, and an appropriate actuator was constructed. Perturbation of the flow by the actuator was determined to be acceptably small. Boundary-layer profiles were determined on all four walls, and the Mach number distribution was mapped in detail over the diffuser exit cross-section. Surface pressure distributions were measured, and spark schlieren photos were taken for the available pressure ratio range. GRA

N80-17034# Boeing Military Airplane Development, Seattle, Wash. Military Airplane Development Organization.
FORMULATION OF THE THREE DIMENSIONAL TRANSONIC UNSTEADY AERODYNAMIC PROBLEM Interim Report, 15 May 1978 - 15 Feb. 1979
H. Yoshihara Feb. 1979 87 p refs
(Contract F33615-78-C-3201; AF Proj. 2401)
(AD-A075403; AFFDL-TR-79-3030) Avail: NTIS HC A05/MF A01 CSCL 20/4

Unsteady transonic flow for a swept wing of moderate sweep is formulated in the small disturbance limit. Boundary conditions at the wing, the trailing vortex sheet, and the outer computational boundaries are given including the ventilated wall conditions. Shortcomings of the small disturbance hypothesis is reviewed, suggesting means to compensate for them. Viscous interactions are described together with procedures to incorporate their effects. GRA

N80-17035# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SYNTHESIS OF UNSTEADY AERODYNAMIC PROBLEMS CONCERNING HELICOPTERS [SYNTHESE DES PROBLEMES D'AERODYNAMIQUE INSTATIONNAIRE DE L'HELICOPTERE]
J. Gallot Paris Assoc. Aeron. et Astronautique de France 1979 22 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-19; ISBN-2-7170-0546-3) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The impact of unsteady phenomena on the performance of a rotary wing as well as on overall helicopter performance is discussed with emphasis on the ways in which manufacturers try to take these effects into consideration at the design stage. Criteria taken into consideration include operating conditions for different profiles, problems associated with unsteady operation, and the impact of these problems on flight performance. The validity of mathematical models which predict unsteady aerodynamic phenomena, such as flow separation and compressibility is discussed and found to be good at the industrial design level. Author (ESA)

N80-17036# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL STUDY OF THE AERODYNAMICS OF A HELICOPTER ROTOR BLADE MODEL IN AN UNSTEADY FLOW REGIME DURING WIND TUNNEL TESTS
P. Philippe, P. Lafon, and J. C. Bohl 1979 13 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-21; ISBN-2-7170-0548-X) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

Test tools and facilities were developed to understand and analyze flows encountered on helicopter rotor blades. The measurements performed on straight or 30 deg swept blade tips reveal unsteady and tridimensional effects on absolute pressure distributions. The experimental data are also compared with calculations, thus summing up the state of art of available prediction methods. Author (ESA)

N80-17038# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE ANALYSIS OF MEASURED SURFACE LOADS AS A BASIS FOR THE DERIVATION OF ACCEPTABLE LOAD LIMITS FOR MILITARY AIRCRAFT COMPONENTS [DIE ANALYSE VON GEMESSENEN BETRIEBSBEANSPRUCHUNGEN ALS GRUNDLAGE FUER DIE ABLEITUNG VON LASTANNAHMEN FUER MILITAERISCHES FLUGGERAET]
J. M. Azschel and V. Ladda Bonn Dokzentbw May 1979 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-43/RF-430/51038)
(BMVG-FBWT-79-9) Avail: NTIS HC A05/MF A01; Dokzentbw, DM 30

Recent investigations into gust loads on airplanes are reviewed using the theory of turbulence and its application to problems associated with flight in turbulence. The statistical description of turbulence and the dynamic response of the structure

due to gusts are considered. In most cases, the results are presented in terms of cumulative frequency distributions and power spectra for independent gust components. The statistical dependence of the components is omitted in this case even though it must be considered for example in the design of T-tails. More information is needed regarding the gust gradients which must be known when assuming a single gust model for the design of aircraft components. Models which were developed and verified by means of measured load-time histories during service are presented to aid in solving the problems addressed.
Author (ESA)

N80-17040# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DESCRIPTION AND REPORT ON THE CALIBRATION OF AN UNSTEADY FLOW WIND TUNNEL. PART 1. THE UNSTEADY LIFT GENERATED ON AN AIRFOIL AT MODERATE INCIDENCE TO A FLOW CONTAINING STREAMING OSCILLATIONS, PART 2
J. M. R. Graham May 1979 24 p refs
(IC-Aero-79-04-Pt-1/2; ISSN-0308-7247) Avail: NTIS HC A02/MF A01
A first set of velocity and pressure measurements made in an unsteady flow wind tunnel are presented. The wind tunnel provides a low-speed mean flow superimposed streamwise oscillations of variable amplitude generated by rotating vanes at the downstream end. The fluctuating lift on an unstalled airfoil at incidence in an unsteady streamwise flow was measured and compared with predictions of unsteady thin airfoil theory.
Author (ESA)

N80-17041# Royal Aircraft Establishment, Farnborough (England).
HOLOGRAPHIC INTERFEROMETRY OF CARBON FIBER REINFORCED PLASTIC WINGTIPS
M. Marchant London HMSO Aug. 1978 63 p refs
(RAE-TR-78105; BR68663) Avail: NTIS HC A04/MF A01
Seven experimental Harrier ferry-tips were examined by holographic interferometry primarily for defects in core to skin bonding. With increasing experience, the quality of the holograms recorded improved and although the interference patterns formed when the structure is warmed are often complicated, discontinuities are readily observed. A number of suspected defects were found which are virtually undetectable using standard radiographic techniques. The most prominent of these are the long straight anomalies visible on all but the first sample examined. It is thought that they may be due to overlapping sheets of film adhesive, but this was not established with certainty. An ultrasonic scan of one sample also failed to detect it. Small circular patterns, possibly indicating debonds, were found in a number of place. A group of large anomalies observed on one sample were confirmed by radiography. Author (ESA)

N80-17042# Lockheed-California Co., Burbank.
GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS USER'S MANUAL. VOLUME 2: INPUT-OUTPUT, TECHNIQUES AND APPLICATIONS Final Report, Jun. 1976 - Feb. 1978
Max A. Gamon, Gil Wittlin, and William L. LaBarge Sep. 1979 253 p
(Contract DOT-FA75WA-3707)
(AD-A075949; LR-28307-Vol-2-Rev;
FAA-RD-77-189-Vol-2-Rev) Avail: NTIS HC A12/MF A01 CSCL 01/3
A comprehensive description of program KRASH is provided. The following are included: user's guide; math model development; KRASH data requirements; and typical model arrangements.
R.C.T.

N80-17043# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ACCIDENT DATA SYSTEMS STUDY REQUIREMENTS ANALYSIS FOR A FAA ACCIDENT DATA SYSTEM Final Report, Oct. 1977 - Jul. 1979
Ellis V. Couch, Ron M. Hill, T. Kolankiewicz, and Gerald Skelton Aug. 1979 167 p refs
(FAA Proj. 014-100-100)
(AD-A075611; FAA-NA-79-172) Avail: NTIS HC A08/MF A01 CSCL 01/2
The Federal Aviation Administration is investigating possible improvements in its accident data system to enhance aviation safety because the present data system is limited in scope, difficult to use, and of little benefit to aviation safety analysts. The immediate needs which can be met in the near term as well as improvements which will necessitate extensive changes in data collection forms, procedures, and methodologies are analyzed. Other similar data systems are examined, previous related studies are reviewed, and recommendations from users of accident data systems are surveyed. The FAA Flight Standards Service incorporated additional data elements, improved software for better data access, and other near term improvements in the General Aviation Accident Data System now under development. These improvements are evolutionary steps toward the fulfillment of the long range requirements. A.R.H.

N80-17044# Air Force Academy, Colo. Research Lab.
CARGO GENERATION FORECASTING MODELS
John S. Brush Oct. 1979 11 p refs
(AF Proj. 2304)
(AD-A076136; FJSRL-TR-79-0010) Avail: NTIS HC A02/MF A01 CSCL 15/5
Time series models of daily cargo generated for two MAC channels are developed. The strong weekly cyclical fluctuation is exploited in developing forecasting models using both past cargo generation and past cargo arrivals as inputs. GRA

N80-17045# Dayton Univ., Ohio.
THE SCALING OF BIRD IMPACT LOADS Final Report, 16 Jan. 1978 - 16 Feb. 1979
Antonios Challita and John P. Barber Jun. 1979 67 p refs
(Contract F33615-78-C-3402; AF Proj. 2402)
(AD-A075215; UDR-TR-79-23; AFFDL-TR-79-3042) Avail: NTIS HC A04/MF A01 CSCL 14/2
This report describes an experimental study which was conducted to investigate the loads produced by the impact of 1800 g and 3600 g birds. Both real birds and bird simulants were tested. Impact pressures were measured and compared with smaller bird impact results obtained on previous testing programs. The magnitude of the impact pressures was found to be independent of bird size. The temporal and spatial distribution of impact pressures scaled linearly with bird dimensions. The impact behavior of large birds was consistent with flow models developed to describe small bird impacts. It was concluded that large and small birds display the same fundamental impact loading processes and that these processes are adequately described by the previously developed flow model. GRA

N80-17046# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCED DESIGN AIRCREW PROTECTIVE RESTRAINT SYSTEMS Final Report
A. Blair McDonald Aug. 1979 59 p refs
(Contract F33615-78-C-0509)
(AD-A076061; AMRL-TR-79-45) Avail: NTIS HC A04/MF A01 CSCL 01/3
This study is the initial phase of a program aimed at the development of advanced design aircrew systems for the next generation of Air Force combat aircraft. For these new aircraft, it is anticipated that combat operations will involve high multiaxial acceleration maneuvers and that new aircrew systems w ll be required for restraint, protection and escape under these combat conditions. GRA

N80-17047# Federal Aviation Administration, Washington, D. C. Flight Transportation Lab.
REVIEW AND EVALUATION OF NATIONAL AIRSPACE SYSTEM MODELS Final Report, Jan. - Dec. 1978

A. R. Odoni and R. W. Simpson Oct. 1979 357 p refs
(Contract DOT-TSC-1491)
(AD-A078050; FAA-EM-79-12; DOT-TSC-FAA-79-8) Avail: NTIS HC A16/MF A01 CSCL 17/7

A guide to the availability and capability of state of the art analytical and simulation models of the national airspace system (NAS) is presented. A listing of 230 reports containing technical descriptions of models developed during the last decade are reviewed with 50 distinct models described. The reports are classified into primary categories based on applicability of the model to various aspects of the NAS. Capacity/delay models are classified as capacity oriented runway, delay oriented runway, complete airport, terminal airspace, air route traffic (including communications), controller workload and performance, and models of major segments of the NAS. Reports describing models primarily concerned with safety related measures and noise related measures are categorized separately. Information contained in each model review includes report ID, abstract, input/output parameters, computer related characteristics, assumptions, quality of documentation, extent of validation, and an evaluation of the model's usefulness and limitations. The reports also contain a comparative evaluation of models in the same primary category. These evaluations present an overview of the models contained in each category, summarize the main features of the best models, and document the conclusions and recommendations regarding the model best suited for specific applications. A.W.H.

N80-17048# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SUMMARY OF TRANSPONDER DATA Interim Report, Jun. 1977 - Aug. 1978
Max Greenberg Aug. 1979 53 p refs
(FAA Proj. 031-241-830)
(AD-A075486; FAA-RD-79-56; FAA-NA-79-23) Avail: NTIS HC A04/MF A01 CSCL 17/7

The performance characteristics of transponders and digitized encoded altimeters were determined in the operational environment of general aviation aircraft. A transponder performance analyzer (TPA), developed to measure performance parameters of transponders installed in aircraft is described. The TPA installed in a bus for mobility, simulates an air traffic control beacon interrogator to facilitate measurement of 15 transponder parameters in 30 seconds. A standard gain horn is utilized to couple the signals between the TPA bus and the aircraft. Transponder data were collected at four different geographic locations resulting in more than 950 samples of general aviation transponders. Results presented in tabular form, show that 36 percent of the transponders met all measured parameters. The TPA operation and procedures are reported and the data collection and sampling techniques are discussed. A.W.H.

N80-17049# National Aviation Facilities Experimental Center, Atlantic City, N. J.
COMPUTER STUDY OF TULSA INTERNATIONAL AIRPORT RUNWAY 17R GLIDE SLOPE SITES Final Report, Feb. - Nov. 1978
Thomas J. Laginja Sep. 1979 44 p refs
(FAA Proj. 071-713-800)
(AD-A075521; FAA-RD-79-27; FAA-NA-79-8) Avail: NTIS HC A03/MF A01 CSCL 17/7

The effect of the terrain at the approach end of Tulsa International Airport runway 17R on guidance signals radiated from an instrument landing system glide slope antenna system is examined. The performances of capture effect, sideband reference, and null reference systems were compared using a mathematical simulation model in order to select the antenna system that will result in the least perturbation of signal. The model, the modeling technique, and the application of the model are described along the input data. A.W.H.

N80-17050# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
REPORT ON THE FAA TASK FORCE ON AIRCRAFT SEPARATION ASSURANCE. VOLUME 2: CONCEPT DESCRIPTION
N. A. Blake Jan. 1979 69 p refs
(AD-A077807; FAA-EM-78-19-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 17/7

The development of the integrated aircraft separation assurance (ASA) system for the National Airspace System is discussed with emphasis on system errors, mid-airs, and near mid-airs, and altitude deviations. The system element requirements are defined to provide two levels of backup to the ATC system: a separation violation warning and a final fail safe collision advisory and resolution function. The current FAA ASA development programs are discussed as well as the changes required to transition to an integrated ASA system. A.R.H.

N80-17051# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DEFORMOGRAPHICS: HIGH-RESOLUTION PROJECTION DISPLAY DEVELOPMENT FOR AIR TRAFFIC CONTROL PURPOSES Report, Jan. 1973 - Dec. 1978
Gerard Spanier Oct. 1979 224 p refs
(FAA Proj. 975-200-00A)
(AD-A078023; FAA-NA-79-24) Avail: NTIS HC A10/MF A01 CSCL 17/7

A display device and technology called deformographics is described and its practical value for the presentation of large quantities (e.g., 30,000 characters) of air traffic control data was investigated. The engineering, development, human factors, and test and evaluation phases are included and the technical performance data and applications concepts are provided. The project determined the viability of the technology, established the basis for further operational concept studies, and assessed the reproducibility of devices and performance based on the technology. The results indicate a wide use of the technology for air traffic control data and information presentation, as well as other similar applications, and indicate a significant superiority of performance over other conventional and emerging display technologies. R.C.T.

N80-17057# Champlain Technology Industries, Palo Alto, Calif.
AIRBORNE EVALUATION OF THE PRODUCTION AN/ARN-133 LORAN-C NAVIGATOR Final Report
Richard J. Adams and John B. McKinley Jul. 1979 260 p refs
(Contract DOT-FA75WA-3662)
(AD-A075484; USCG-D-32-79) Avail: NTIS HC A12/MF A01 CSCL 17/7

This report presents the results of a comprehensive flight test evaluation of a production airborne Loran-C navigator. The test was performed on a FAA approved helicopter route in the Northeast Corridor, at NAFEC in Atlantic City, New Jersey and in the Gulf of Mexico. The test aircraft used were United States Coast Guard HH52 and HH53 helicopters. The test period was from June 1978 to January 1979. The test plan and test objectives were developed jointly by the United States Coast Guard and the Federal Aviation Administration and Systems Control, Inc. (Vt), Champlain Technology Industries Division. The flight test profiles and procedures were developed for the following reasons: (1) to assess the acceptability of Loran-C navigation in the operational ATC environment of the Northeast Corridor; (2) to determine the system use accuracy for Loran-C for enroute, terminal and non-precision approach flight; (3) to evaluate the Loran-C navigator performance in several offshore missions. The primary conclusions of this flight test evaluation were: the navigator was acceptable in the operational environment of the Northeast Corridor for both enroute and point-in-space approaches; the navigator satisfied AC 90-45A crosstrack accuracy requirements for enroute, terminal area and non-precision approaches; the production navigator satisfied a longtrack AC 90-45A accuracy requirements for enroute and terminal area, but not for non-precision approaches; the navigator performed acceptably during all phases of offshore testing. GRA

N80-17060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF ANALYTICAL AND FLIGHT TEST IDENTIFIED AERODYNAMIC DERIVATIVES FOR A TANDEM-ROTOR TRANSPORT HELICOPTER

Ward F. Hodge Feb. 1980 56 p refs
(NASA-TP-1581; L-13228) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight tests for verifying an analytical aerodynamic derivative model of a CH-47 helicopter were conducted for low cruise speeds and transition to hover portions of curved, decelerating landing approach trajectories. All testing was performed on a closed loop basis with the stability augmentation system of the helicopter operating, and response data were obtained using both manual and computer generated input maneuvers. The results indicate some differences between the measured response time histories and those predicted by both analytical and flight test identified derivatives. With some exceptions the discrepancies are not severe, and the overall agreement between the measured and computed time histories is reasonably good. No adverse effects attributable to closed loop testing were noted, and the use of computer generated inputs proved to be superior to manual ones. Author

N80-17061*# Missouri Univ. -Rolla. Dept. of Mechanical and Aerospace Engineering.
AERODYNAMIC-STRUCTURAL ANALYSIS OF DUAL BLADED HELICOPTER SYSTEMS Final Technical Report
Bruce P. Selberg, Donald L. Cronin, Kamran Rokhsaz, John R. Dykman, and Carla J. Yager Feb. 1980 46 p refs
(Grant NsG-2375)
(NASA-CR-162754) Avail: NTIS HC A03/MF A01 CSCL 01C

The aerodynamic and structural feasibility of the birotor blade concept is assessed. The inviscid flow field about the dual bladed rotor was investigated to determine the aerodynamic characteristics for various dual rotor blade placement combinations with respect to blade stagger, gap, and angle of attack between the two blades. The boundary layer separation on the rotors was studied and three dimensional induced drag calculations for the dual rotor system are presented. The thrust and power requirements of the rotor system were predicted. NASTRAN, employed as the primary modeling tool, was used to obtain a model for predicting in plane bending, out of plane bending, and the torsional behavior of the birotors. Local hub loads, blade loads, and the natural frequencies for the birotor configuration are discussed. A.W.H.

N80-17062*# Arde, Inc., Mahwah, N.J.
DESIGN STUDY OF PRESTRESSED ROTOR SPAR CONCEPT Final Report, Mar. 1975 - Jun. 1976
David Gleich Jan. 1980 101 p refs Sponsored in part by the Army Aviation Res. and Develop. Command
(Contract NAS1-13816)
(NASA-CR-159086; ARDE-J/N-41005) Avail: NTIS HC A06/MF A01 CSCL 01C

Studies on the Bell Helicopter 540 Rotor System of the AH-1G helicopter were performed. The stiffness, mass and geometric configurations of the Bell blade were matched to give a dynamically similar prestressed composite blade. A multi-tube, prestressed composite spar blade configuration was designed for superior ballistic survivability at low life cycle cost. The composite spar prestresses, imparted during fabrication, are chosen to maintain compression in the high strength cryogenically stretchformed 304-L stainless steel liner and tension in the overwrapped HTS graphite fibers under operating loads. This prestressing results in greatly improved crack propagation and fatigue resistance as well as enhanced fiber stiffness properties. Advantages projected for the prestressed composite rotor spar concept include increased operational life and improved ballistic survivability at low life cycle cost. M.M.M.

N80-17063# Lockheed-Georgia Co., Marietta.
AERODYNAMIC INVESTIGATION OF C-141 LEADING EDGE MODIFICATION FOR CRUISE DRAG REDUCTION, VOLUME 1. Final Technical Report, Jun. 1977 - Sep. 1978
W. T. Blackerby and P. R. Smith Wright-Patterson AFB, Ohio AFFDL Jun. 1979 172 p refs
(Contract F09603-77-A-0204; AF Proj. 2404)
(AD-A076610; LG78ER0233-Vol-1; AFFDL-TR-79-3059-Vol-1)
Avail: NTIS HC A08/MF A01 CSCL 01/3

A study was made of the aerodynamic design and high speed wing tunnel investigation of wing leading edge modifications for cruise drag reduction on the C-141 aircraft. Also investigated were the effects of a wing swept tip extension and trailing edge anti-drag bodies. These modifications were tested in the AEDC 16-Foot Transonic Facility, using a 0.044 scale C-141B model, to determine the effects on C-141 cruise aerodynamic characteristics and wing chordwise pressure distributions. Design of the leading edge modifications was based on the use of transonic wing theory, transonic airfoil theory and experience previously gained with a two-dimensional airfoil leading edge modification program. Force data results were analyzed to determine the effects on C-141 cruise drag, drag rise characteristics and cruise performance. Correlations were made with transonic theory using the measured chordwise pressure distributions. A fuel and cost savings evaluation was made of the selected leading edge configuration based on measured and predicted cruise performance improved. GRA

N80-17064# McDonnell Automation Co., St. Louis, Mo.
EFFECT OF SERVICE ENVIRONMENT ON F-15 BORON/EPOXY STABILATOR Final Report, Aug. 1977 - Jun. 1979
T. V. Hinkle Jun. 1979 137 p refs
(Contract F33615-77-C-3124; AF Proj. 2401)
(AD-A076493; AFFDL-TR-79-3072) Avail: NTIS HC A07/MF A01 CSCL 11/4

The objective of this program was to conduct a series of tests for evaluating the effects of service environment on the strength of the boron/epoxy skins which are an integral part of the F-15 horizontal stabilator. Full scale static tests were conducted on two stabilators, and test results were compared with the capability of the F-15 stabilator demonstrated in previous testing. Moisture contents at various locations in the composite skins were predicted by evaluating the environmental histories of both test articles. Predicted contents were corroborated by moisture contents measured at conclusion of the static tests. F-15 deployments were projected for a 25 year service life, and moisture contents of stabilator composite skins were calculated for each projected deployment. Structural element tests were conducted under the maximum temperature and absorbed moisture conditions expected in service. Physical and chemical characteristics of the test article skins were evaluated relative to baseline boron/epoxy characteristics. GRA

N80-17065# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
THE A-10 AND DESIGN-TO-COST: HOW WELL DID IT WORK?
Roger E. Carleton May 1979 52 p refs
(AD-A075437) Avail: NTIS HC A04/MF A01 CSCL 05/1

This document covers systems procurement in a design-to-cost atmosphere. Deficiencies in this program are identified and recommendations are offered to improve this lack of responsiveness. GRA

N80-17066# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.
THE ACCELEROMETER METHODS OF OBTAINING AIRCRAFT PERFORMANCE FROM FLIGHT TEST DATA DYNAMIC PERFORMANCE TESTING
William R. Simpson Jun. 1979 402 p refs
(AD-A075226; CNA-PP-245) Avail: NTIS HC A18/MF A01 CSCL 01/3

There are, in general, two basic methods of obtaining aircraft performance from flight test data. The first of these methods, the Direct method, is to fly a particular maneuver of interest and mathematically correct this maneuver to a given set of standard conditions. Several similar maneuvers at different flight conditions are then combined in a composite map representing one aspect of the aircraft performance. The Indirect method is more subtle and has its basis deeper in theory. By this method, a group of aerodynamic and propulsion parameters are developed which in themselves are only numbers and do not represent performance. These parameters are not tied to a specific maneuver or maneuver type, but in general relate the physical forces required

to achieve a certain flight condition. Such parameters for an aircraft would be the drag coefficient, lift coefficient, thrust available, fuel flow requirements, etc. However, these parameters can be combined with known facts about the airframe and propulsion system in such a fashion as to compute airplane performance. With the advent of highly accurate accelerometers, the dynamic maneuvers have become attractive for development of aerodynamic data when obtaining aircraft performance using the Indirect Method. GRA

N80-17067# Textron Bell Helicopter, Fort Worth, Tex.
INVESTIGATION OF THE CRASH-IMPACT CHARACTERISTICS OF ADVANCED AIRFRAME STRUCTURES Final Report
James D. Cronkhite, Thomas J. Haas, Victor L. Berry, and Robert Winter Sep. 1979 222 p refs
(Contract DAAJ02-77-C-0062; DA Proj. 1L2-62209-AH-76)
(AD-A075163; USARTL-TR-79-11) Avail: NTIS HC A10/MF A01 CSCL 01/3

The purpose of this program was to investigate the crash-impact characteristics of advanced troop transport helicopter airframe structures constructed of composite materials. Currently available information was surveyed on the crash-impact behavior of composite materials, analytical tools for design of crash-worthy airframe structures, and airframe structure crashworthiness design criteria. Information on the crash-impact behavior of composite materials was found to be limited. Automotive studies showed that by innovative design, composite materials could function efficiently as energy absorbers to reduce crash-impact loads. Other pertinent studies were found that are currently in progress at Bell Helicopter Textron, the NASA Langley Research Center and the U.S. Army's Research and Technology Laboratories and are summarized. Finally, effects of composite materials on the compliance of airframe structures with current Army crashworthiness requirements are discussed. GRA

N80-17068# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE APPLICATION OF A PARAMETERIC METHOD OF FATIGUE LOAD MEASUREMENT TO WINGS BASED ON FLIGHT MEASUREMENTS ON A LIGHTNING MK T5
Anne Burns, J. P. Thompson, and G. E. King HMSO Nov. 1977 59 p refs Supersedes RAE-TR-77178 and ARC-37708 Original contains color illustration
(ARC-R/M-3836; BR69023; ISBN-0-11-471169-0; RAE-TR-77178; ARC-37708) Avail: NTIS HC A04/MF A01; HMSO £10.00; PHI

The application of a parametric method for deriving fatigue loads for fighter aircraft wings is studied. The load is deduced from a statistical correlation with an appropriate combination of aircraft motion variables and control surface angles. The combined effect of symmetric and asymmetric loading is considered. Flights measurement are centered on Lightning fighter aircraft, but the scope is limited by the lack of ground load calibrations for the wing strain gages. This necessitated the development of parametric formulas for local rather than overall loads. Author (ESA)

N80-17069# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
SESAME: A SYSTEM OF EQUATIONS FOR THE SIMULATION OF AIRCRAFT IN A MODULAR ENVIRONMENT
B. N. Tomlinson London HMSO Jan. 1979 151 p refs
(RAE-TR-79008; BR68659) Avail: NTIS HC A08/MF A01

A system of equations was developed for the simulation of aircraft motion in real time using a digital computer. Those parts of the mathematical model common to all aircraft were created as a set of FORTRAN subroutines, leaving the user to create only a small group of routines specifically to describe a particular aircraft. The equations employed are defined and the computer implementation described. The data presented can be used as a handbook and user guide. Because the routines described are not specific to real time simulation, they can also be used as a basis for a general mathematical model of an aircraft for use on any computer which handles FORTRAN. Author (ESA)

N80-17070# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT AVCO LYCOMING TIO-540-J2BD PISTON ENGINE Final Report
Eric E. Becker Sep. 1979 101 p refs
(FAA Proj. 201-521-100)
(AD-A075355; FAA-RD-79-68; FAA-RD-79-36) Avail: NTIS HC A06/MF A01 CSCL 21/7

The TIO-540-J2BD engine (S/N890-X) was tested at the National Aviation Facilities Experimental Center to develop a steady state exhaust emissions data base. This data base consists of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule could not meet the proposed Environmental Protection Agency standard for carbon monoxide and unburned hydrocarbons (HC) under sea level standard-day conditions. The engine did, however, meet the proposed EPA standards for oxides of nitrogen under the same sea level conditions. The results show a trend toward higher levels of emissions output for CO and HC when the ambient conditions approximated hot day sea level conditions while producing slightly lower levels of nitrogen oxides. Author

N80-17071*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCES OF THREE FAN STATOR DESIGNS OPERATING WITH ROTOR HAVING TIP SPEED OF 337 METERS PER SECOND AND PRESSURE RATIO OF 1.54. 1: EXPERIMENTAL PERFORMANCE
Thomas F. Gelder Feb. 1980 108 p refs
(NASA-TP-1610; E-136) Avail: NTIS HC A06/MF A01 CSCL 21E

The aerodynamic performances of four stator-blade rows are presented and evaluated. The aerodynamic designs of two of these stators were compromised to reduce noise, a third design was not. On a calculated operating line passing through the design point pressure ratio, the best stator had overall pressure-ratio and efficiency decrements of 0.031 and 0.044, respectively, providing a stage pressure ratio of 1.483 and efficiency of 0.865. The other stators showed some correctable deficiencies due partly to the design compromises for noise. In the end-wall regions blade-element losses were significantly less for the shortest chord studied. Author

N80-17072# Volvo Flygmotor A.B., Trollhaettan (Sweden).
EFFECTS OF DESIGN PARAMETERS ON COOLING AIR REQUIREMENT IN A GAS TURBINE COMBUSTOR
Bjorn G. A. Sjoblom 22 Aug. 1979 34 p refs Backup document for AIAA synoptic scheduled for publication in Journal of Aircraft on May 1980
(Log-C3797) Avail: NTIS HC A02/MF A01

A computer program for the preliminary design of aircraft gas turbine combustors was used for a parametric study. The program is based on established methods for wall temperature calculations and it determines the main dimensions, the air flow distribution and the film cooling air requirement. Effects of design parameters on the cooling air flow in an aircraft gas turbine combuster were studied. Variation of the overall pressure ratio gave a similar trend as data for existing combustors. It was also found that the percentage of cooling air for a typical design is roughly proportional to the overall pressure ratio to the 0.85 power multiplied by the turbine inlet temperature to the 2.4 power TIT 2.4, which provides a simple extrapolation formula for existing combustors. Author

N80-17073*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
DISTRIBUTION ANALYSIS FOR F100(3) ENGINE Final Report
W. A. Walter and M. Shaw Jan. 1980 66 p refs
(Contract NAS3-20835)
(NASA-CR-159754; FR-12087) Avail: NTIS HC A04/MF A01 CSCL 21E

The F100(3) compression system response to inlet circumferential distortion was investigated using an analytical compressor flow model. Compression system response to several types of distortion, including pressure, temperature, and combined pressure/temperature distortions, was investigated. The predicted response trends were used in planning future F100(3) distortion tests. Results show that compression system response to combined temperature and pressure distortions depends upon the relative orientation, as well as the individual amplitudes and circumferential extents of the distortions. Also the usefulness of the analytical predictions in planning engine distortion tests is indicated. J.M.S.

N80-17074*# Pratt and Whitney Aircraft, East Hartford, Conn.
EXPERIMENTAL EVALUATION OF A LOW EMISSIONS HIGH PERFORMANCE DUCT BURNER FOR VARIABLE CYCLE ENGINES (VCE) Final Report
R. P. Lohmann and R. J. Mador Oct. 1979 118 p refs
(Contract NAS3-20602)
(NASA-CR-159694; PWA-5513-32A) Avail: NTIS HC A06/MF A01 CSCL 21A

An evaluation was conducted with a three stage Vorbix duct burner to determine the performance and emissions characteristics of the concept and to refine the configuration to provide acceptable durability and operational characteristics for its use in the variable cycle engine (VCE) testbed program. The tests were conducted at representative takeoff, transonic climb, and supersonic cruise inlet conditions for the VSCE-502B study engine. The test stand, the emissions sampling and analysis equipment, and the supporting flow visualization rigs are described. The performance parameters including the fuel-air ratio, the combustion efficiency/exit temperature, thrust efficiency, and gaseous emissions calculations are defined. The test procedures are reviewed and the results are discussed A.W.H.

N80-17075# Massachusetts Inst. of Tech., Cambridge. Gas Turbine and Plasma Dynamics Lab.
BOUNDARY LAYER AND WAKE MODIFICATIONS TO COMPRESSOR DESIGN SYSTEMS: THE EFFECT OF BLADE-TO-BLADE FLOW VARIATIONS ON THE MEAN FLOW FIELD OF A TRANSONIC ROTOR Final Report, 1 Sep. 1976 - 31 Aug. 1978
Arun K. Sehra Wright-Patterson AFB, Ohio AFAPL Mar. 1979 218 p refs
(Contract F33615-76-C-2118; AF Proj. 2307)
(AD-A076204; GT/PDL-144; AFAPL-TR-79-2010) Avail: NTIS HC A10/MF A01 CSCL 21/5

The effect of blade-to-blade flow variations on the mean flow field of a highly loaded transonic axial flow compressor was investigated. The theoretical approach centered around modeling of three important phenomena associated with blade-to-blade flow fluctuations, which control the mean momentum and energy transfer processes. Apparent stresses were introduced into the mean flow momentum equations by pitchwise averaging. Loss concept of mean relative total pressure, due to conversion of mean flow kinetic energy to the energy of fluctuations, was introduced. Based on this concept, mean rothalpy and the production of apparent entropy were defined. An expression for mean rothalpy variation along the streamline was derived by pitchwise averaging of the energy equation. Mean flow equations suitable for the streamline curvature computational scheme were developed which include these three effects. Apparent stresses, mean rothalpy and apparent entropy variations were calculated from measured velocity fluctuations. The revised streamline curvature procedure was then used to predict the axisymmetric (peripheral mean) flow. The agreement of rotor outlet tangential velocity is excellent, reproducing an unusual peak which is not explainable by usual techniques. The results showed that 3-D inviscid effects do not significantly modify the mean flow, and that the direct effect of apparent stresses on the mean flow is also small. GRA

N80-17077# Aeronautical Research Council, London (England).
VORTEX SHEDDING MECHANISMS IN RELATION TO TIP CLEARANCE FLOWS AND LOSSES IN AXIAL FANS
R. I. Lewis (Newcastle Univ. Engl.) and E. C. H. Yeung (Newcastle Univ. Engl.) London HMSO May 1977 37 p refs Supersedes ARC-37359
(ARC-R/M-3829; ISBN-0-11-471162-3; ARC-37359) Avail: NTIS HC A03/MF A01; HMSO £4.00; PHI

The importance of tip leakage flows in axial fans as a source of loss is evaluated. The dimensionless loss is related to a range of dimensionless parameters by application of a jet loss theory. Vortex shedding models are presented. Theoretical predictions of lift coefficient reduction are compared with published experimental data for isolated rectangular plates, with experimental tests for a single airfoil adjacent to a wall with an oncoming boundary layer, and with correlations of the percentage reduction in total lift versus gap chord ratio. Author (ESA)

N80-17080# SRI International Corp., Menlo Park, Calif.
PILOTED FLIGHT SIMULATION STUDY OF LOW-LEVEL WIND SHEAR, PHASE 4. ALL-WEATHER LANDING SYSTEMS, ENGINEERING SERVICES SUPPORT PROJECT, TASK 2 Interim Report, Apr. 1978 - Mar. 1979
W. H. Foy and W. B. Gartner Mar. 1979 148 p refs
(Contract DOT-FA75WA-3650; SRI Proj. 4364)
(AD-A077164; FAA-RD-79-84) Avail: NTIS HC A07/MF A01 CSCL 01/2

The fourth in a series of piloted DC10 flight simulation exercises concerned with the development and test of airborne techniques designed to aid the pilot in detecting and coping with low level wind shear are described. The exercise included validation tests of systems developed from the techniques that had shown the most promise in previous tests. Approach and landing situations were simulated, using manual control assisted by flight director. Takeoff trials were run against 5 wind profiles by the 3 project pilots. No good airborne means of coping with wind shear were found. R.C.T.

N80-17081*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TESTS OF THE TOTAL AUTOMATIC FLIGHT CONTROL SYSTEM (TAFCOS) CONCEPT ON A DHC-6 TWIN OTTER AIRCRAFT
William R. Wehrend, Jr. and George Meyer Feb. 1980 73 p refs
(NASA-TP-1513; A-7901) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight control systems capable of handling the complex operational requirements of the STOL and VTOL aircraft designs as well as designs using active control concepts are considered. Emphasis is placed on the total automatic flight control system (TACOS) (TAFCOS). Flight test results which verified the performance of the system concept are presented. J.M.S.

N80-17082# Honeywell Systems and Research Center, Minneapolis, Minn.
DIGITAL FLIGHT CONTROL SOFTWARE VALIDATION STUDY Final Report, Apr. 1978 - Apr. 1979
Edward R. Rang, Michael J. Gutmann, Dennis B. Mulcare, and William G. Ness Wright-Patterson AFB AFFDL Jun. 1979 257 p refs
(Contract F33615-78-C-3605)
(AD-A076021; HONEYWELL-79SRC18; AFFDL-TR-79-3076) Avail: NTIS HC A12/MF A01 CSCL 01/3

The problems of designing, verifying, and validating software for digital flight control systems are reviewed to study how the new software engineering tools and techniques may be incorporated into the development process. This shows how automated methodologies will provide error-free flight control software at lower costs. The need for expensive, lengthy test programs is reduced by analytical methods. The quality of the software is demonstrated with higher confidence when designs are structured to facilitate the subsequent verification steps. The military standards relating to flight control systems are reviewed, and modifications to include provisions for software verification are recommended. GRA

N80-17083# National Aeronautical Establishment, Ottawa (Ontario).

THEORETICAL ANALYSIS OF THE TRANSIENT RESPONSE OF A WING TO NON-STATIONARY BUFFET LOADS
B. H. K. Lee Apr. 1979 86 p refs
(AD-A073702; NAE-LR-597; NRC-17465) Avail: NTIS HC A05/MF A01 CSCL 20/4

A method for predicting the response of a wing to non-stationary buffet loads is presented. The wing is treated as a cantilever beam with known mass distribution. Using generalized co-ordinates, the vibration of the wing is governed by the second order mass-spring-damper oscillator equation. The buffet load on the wing is expressed as an integral of the sectional force, which is a function of the spanwise location and time. The non-stationary load is represented by the product of a deterministic time function and a statistically stationary random function. The time history of the applied load is segmented into a number of time intervals. Analytical expressions for the mean square response of the wing displacement are derived using a power spectral density for the random part of the applied load, similar to that used in the theory of isotropic turbulence. The effects of damping, ratio of the undamped natural frequency of the system to the half power frequency of the power spectral density, length of time segment, and duration of applied load on the response of the wing have been investigated for three examples of the load versus time histories. (GRA)

N80-17084# Universite des Sciences et Techniques de Lille (France).
INITIAL STUDY OF THE RESPONSE OF AN AIRCRAFT TO LATERAL GUSTS [RESPONSE DE L'AVION AUX RAFALES LATERALES. ETUDES EXPLORATOIRE]
J. L. Cocquerez and R. A. Verbrugge Paris Assoc. Aeron. et Astronautique de France 1979 37 p In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-03) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

The study of aircraft performance in turbulence, especially the response to lateral gusts, is required in order to optimize the use of automatic flight control systems. Those flight conditions emphasized include low altitude approach, landing with wind composed of transversal gusts, and stability at steep angles of attack at low speeds. The preponderant effects of gust loads vis-a-vis degrees of freedom, the roles of the various control surfaces of the aircraft, and the responses of different aircraft planforms are shown, leading to the modelization of these phenomena. Author (ESA)

N80-17085# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE IDENTIFICATION OF THE FLUTTER MECHANISM FROM A LARGE-ORDER FLUTTER CALCULATION
J. C. A. Baldock London HMSO Feb. 1978 48 p refs Supersedes RAE-TR-78017 and ARC-37871
(ARC-R/M-3832; ISBN-0-11-47116-8; RAE-TR-78017; ARC-37871) Avail: NTIS HC A03/MF A01; HMSO £5.00; PHI

The phase differences between degrees of freedom in a flutter calculation are discussed. From the study of phase variation with airspeed in binary systems, a technique is evolved for identifying the essential degrees of freedom in a large-order flutter calculation. This technique can be combined with a general flutter analysis in order to represent the flutter condition in a large-order flutter calculation with an equivalent two degree of freedom system. Author (ESA)

N80-17087# Vehicle Systems Development Corp., Upland, Calif.
DETAILED DESIGN AND FABRICATION OF A HELICOPTER GROUND MOBILITY SYSTEM (HGMS) Final Technical Report, Oct. 1977 - May 1979
Robert W. Forsyth, John P. Forsyth, Nathan N. Shiovitz, and Laurence E. Reinhart Sep. 1979 47 p refs
(Contract DAAJ02-77-C-0077)
(AD-A076932; VSDC-579/43; USARTL-TR-79-24) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report presents the results of a program for the design, fabrication, test, and demonstration of two identical engineering models of the Helicopter Ground Mobility System (HGMS). Task 1 resulted in a complete, detailed and documented design for the HGMS prime mover, skid-equipped helicopter adapter, and flotation track assemblies. In Task 2, the design was converted into hardware which, along with a device simulating the wheel-equipped UH-60A (Black Hawk) and YAH-64 (AAH) helicopters, was tested in Task 3 to demonstrate compliance with the requirement and specification for the HGMS. Minor changes, the need for which emerged from the test activity, were incorporated in the engineering models and design data during Task 3. In Task 4, the contractor prepared assessments of HGMS reliability and maintainability as well as estimates of requirements for logistics support. The total program described in this final report produced systems which clearly indicate that Army helicopters, both wheeled and skid-equipped, can be successfully transported between a forward area landing zone and a concealed larger area with no surface preparation and with a minimum of equipment and personnel. Moreover, the program demonstrated that a lightweight and helicopter-transportable HGMS answers the Army's long-standing need for helicopter ground mobility. GRA

N80-17088# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTS FOR THE REDUCTION OF WIND TUNNEL WALL INTERFERENCE BY ADAPTIVE-WALL TECHNOLOGY Final Report, Oct. 1977 - Sep. 1978
E. M. Kraft and R. L. Parker, Jr. AEDC, Arnold AFS, Tenn. Oct. 1979 43 p refs
(AD-A076555; AEDC-TR-79-51) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experiments were conducted in the AEDC Aerodynamic Wind Tunnel (1T) to evaluate the applicability of adaptive-wall technology to reduce wall interference in a transonic wind tunnel. Data were obtained on a six-percent-blockage, two-dimensional, NACA 0012 airfoil section with two different, adaptable porous wall configurations. One configuration featured variable longitudinal control of the local hole angle and the other featured global porosity control. The experiments demonstrated that adaptive-wall techniques could be used to significantly reduce wall interference effects. Although neither wall configuration could be adjusted to duplicate the pressure distributions (calculated at the tunnel boundary control surface with adaptive-wall technology) to produce interference-free conditions, matching the pressure level upstream of the model and minimum pressure in the vicinity of the model adequately reduced the wall interference. One of the most effective means for matching these global parameters was plenum pressure adjustment; thus, some refinement may be obtained through segmented plena control. GRA

N80-17089# Civil Aeronautics Board, Washington, D.C.
AIRPORT ACTIVITY STATISTICS OF CERTIFICATED ROUTE AIR CARRIERS Semiannual Report
31 Dec. 1978 315 p Prepared in cooperation with FAA, Washington, D.C.
(AD-A076194) Avail: NTIS HC A14/MF A01 CSCL 01/2

This report furnishes airport activity of the Certificated Route Air Carriers. Included in the data contained in table 6 are passenger enplanements, tons of enplaned freight, express, and mail. Both scheduled and non-scheduled service, and domestic and international operations are included. These data are shown by airport and carrier. Table 7 includes departures by airport, carrier and type of operation, and type of aircraft. GRA

N80-17090# Boeing Co., Wichita, Kans.
JET ENGINE DEMOUNTABLE TEST CELL EXHAUST SYSTEM PHASE: COANDA/REFRACTION NOISE SUPPRESSION CONCEPT, ADVANCED DEVELOPMENT
R. E. Ballard, W. F. Byers, and D. L. Armstrong Apr. 1979 91 p refs
(Contract N00014-76-C-1229)
(AD-A076253; D3-11527-1; NAEC-92-112) Avail: NTIS HC A05/MF A01 CSCL 01/5

The successfully demonstrated Coanda/refraction air-cooled exhaust noise suppressor system is applied to the Navy requirement for effective exhaust noise suppression in jet engine demountable test cells. The technical approach consists of analytical studies and one-sixth scale model tests using simulated afterburning engine exhaust. Revisions are made to the previously developed system to improve noise suppression capability while reducing the system overall size and initial cost. Revisions include moving secondary air inlets to reduce enclosure size and improve cooling, shortening the Coanda surface to provide more acoustically treated exhaust stack and providing variations in exhaust stack configuration such as single and dual acoustic splitters and acoustic wedges up the back wall. Extensive data were recorded and analyzed to identify the aerothermodynamic and acoustic trends related to these configuration changes. Results present recommendations for an air-cooled Coanda/refraction exhaust system for application to demountable test cells. GRA

N80-17091# Boeing Co., Wichita, Kans.
JET ENGINE CLASS C TEST CELL EXHAUST SYSTEM PHASE. COANDA/REFRACTION NOISE SUPPRESSION CONCEPT-ADVANCED DEVELOPMENT Technical Report, Oct. 1976 - Jan. 1977
R. E. Ballard and D. L. Armstrong Lakehurst, N.J. Naval Air Engineering Center May 1979 89 p refs
(Contract N00140-76-C-1229)
(AD-A075277; D3-11500-1; NAEC-92-113) Avail: NTIS HC A05/MF A01 CSCL 20/1

The successfully demonstrated Coanda/refraction air-cooled exhaust noise suppressor system is applied to the Navy requirement for an effective air-cooled retrofit configuration for the class 'C' test cells (concrete enclosure). The technical approach consists of analytically sizing retrofit components to meet both acoustic and aerothermodynamic requirements and then testing at one-sixth scale using simulated afterburning engine exhaust to verify the design configuration. Model variations included exhaust stack height, exhaust stack inner flow passage configurations (straight walls and diffuser) and removal of a concrete internal partition wall. Extensive data were recorded and analyzed to identify the aerothermodynamic trends related to these configuration changes. Results present recommendations for an air-cooled Coanda exhaust noise suppression system for retrofit of Navy class 'C' test cells. GRA

N80-17092# National Aeronautical Establishment, Ottawa (Ontario).
A PERTURBATION THEORY OF TWO-DIMENSIONAL TRANSONIC WIND TUNNEL WALL INTERFERENCE
Y. Y. Chan Apr. 1979 27 p refs
(AD-A071167; NAE-LR-598; NRC-17476) Avail: NTIS HC A03/MF A01 CSCL 20/4

The wind tunnel wall interference in transonic speed is formulated as perturbation to the basic flow around the airfoil in free air. The perturbation equation is derived from the transonic small disturbance equation and is linear but with variable coefficients containing the non-linear solution of the basic flow. The equation is solved numerically by a direct matrix method using the classical boundary condition for a porous wall. The solution in terms of lift versus angle of attack agrees well with that calculated directly from the small disturbance equation. GRA

N80-17093# Royal Aircraft Establishment, Bedford (England). Structures Dept.
THE REDUCTION OF DYNAMIC INTERFERENCE BY SOUND-ABSORBING WALLS IN THE RAE 3 FOOT WIND TUNNEL
D. G. Mabey London AMSO Aug. 1977 40 p refs Supersedes RAE-TR-77120 and ARC-37618
(ARC-R/M-3837; BR69024; ISBN-0-11-471170-4; RAE-TR-77120; ARC-37618) Avail: NTIS HC A03/MF A01; HMSO £ 5.00; PHI

A preliminary investigation made with temporatory test liners in a 3-ft by 3-ft tunnel confirms that there are significant advantages in using working sections with sound-absorbing walls for aeroelastic tests at subsonic and transonic speeds. In particular, tunnel resonances and flow unsteadiness can be reduced just as effectively in a large wind tunnel as in the small tunnel (4-in by 4-in) used for previous pilot tests. The reduction in flow unsteadiness obtained with sound-absorbing walls significantly improved wind buffeting measurements on an ordinary wind tunnel model. Author (ESA)

N80-17094# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE INFLUENCE OF SIMULATOR MOTION WASH-OUT FILTERS ON THE PERFORMANCE OF PILOTS WHEN STABILIZING AIRCRAFT ATTITUDE IN TURBULENCE
M. F. C. VanGool 1 Feb. 1978 52 p refs
(NLR-TR-78022-U) Avail: NTIS HC A04/MF A01

The influence of simulator motion on the performance of four pilots when stabilizing an aircraft disturbed by turbulence in the pitch and roll axes was investigated. Pilot describing functions, remnant spectra, and a number of associated performance measures were determined for this compensatory tracking task. The results lead to the conclusion that for the task under consideration, no significant differences can be observed when the second-order high-pass wash-out filter break frequency in the pitch and roll degree of freedom is varied from 0.1 rad/sec to 0.5 rad/sec. However, performance in either condition is considerably better than results obtained fixed-based. This is also reflected in the pilot comments and effort ratings, stating that the task is easier with motion. Author (ESA)

N80-17096# Royal Aircraft Establishment, Bedford (England). Structures Dept.
THE USE OF SOUND ABSORBING WALLS TO REDUCE DYNAMIC INTERFERENCE IN WIND TUNNELS
D. G. Mabey London HMSO Nov. 1976 74 p refs Supersedes RAE-TR-76157 and ARC-37436
(ARC-R/M-3831; ISBN-0-114-71164; RAE-TR-7615; ARC-37436) Avail: NTIS HC A04/MF A01; HMSO £7.00; PHI

A scheme for reducing dynamic interference in wind tunnel at subsonic and transonic speeds was tested in a pilot 4in x 4in tunnel. Two types of dynamic interference were considered: excitation of unwanted acoustic resonances within the working section and flow unsteadiness. The models used to establish the resonances in the working sections with hard walls were small circular cylinders operating in a subcritical Reynolds number range and thus generating discrete pressure fluctuations at the vortex shedding frequency. When the resonances were suppressed by the wall materials the pressure fluctuations agreed well with previous measurements made in a much larger, low speed wind tunnel and with predictions. The tests show that both types of interferences could be substantially reduced by replacing the conventional hard walls of a closed or a slotted working section by appropriate sound absorbing walls. Author (ESA)

N80-17143# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
MATERIALS AND STRUCTURES RESEARCH SCIENTIFIC REPORT, 1978 Progress Report [FORSCHUNGSBEREICH WERKSTOFFE UND BAUWEISEN: WISSENSCHAFTLICHER BERICHT STAND 1978]
1978 101 p refs In GERMAN Original contains color illustrations
Avail: NTIS HC A06/MF A01

Research in structural engineering, aerodynamics, the mechanical properties of light alloys and refractory materials, the applications of powder metallurgy, the space environment, energy, health problems, and weightlessness are discussed. Author (ESA)

N80-17147*# Boeing Commercial Airplane Co., Seattle, Wash.
THE 737 GRAPHITE COMPOSITE FLIGHT SPOILER FLIGHT SERVICE EVALUATION Annual Report, May 1978 - Apr. 1979

Daniel J. Hoffman and Robert L. Stoecklin Jan. 1980 56 p refs
(Contract NAS1-11668)
(NASA-CR-159094; AR-5) Avail: NTIS HC A04/MF A01 CSCL 11D

The flight service experience of 111 graphite-epoxy spoilers on 737 transport aircraft and related ground based enviromental exposure of graphite-epoxy material specimens is reported. Spoilers were installed on 28 aircraft representing seven major airlines operating throughout the world. Over 1,188,367 spoiler flight hours and 1,786,837 spoiler landings were accumulated by this fleet. Tests of removed spoilers and ground-based exposure specimens after the fifth year of service indicate modest changes in composite strength properties. Two incidents of trailing edge delamination with subsequent core corrosion were observed. Based on visual, ultrasonic, and destructive testing, there has been no evidence of moisture migration into the honeycomb core and no core corrosion. K.L.

N80-17148*# Boeing Commercial Airplane Co., Seattle, Wash.
PRELIMINARY DESIGN OF GRAPHITE COMPOSITE WING PANELS FOR COMMERCIAL TRANSPORT AIRCRAFT
B. A. Byers and Robert L. Stoecklin Feb. 1980 68 p refs
(Contract NAS1-15107)
(NASA-CR-159150) Avail: NTIS HC A04/MF A01 CSCL 11D

Subjectively assessed practical and producible graphite/epoxy designs were subjected to a multilevel screening procedure which considered structural functions, efficiency, manufacturing and producibility, costs, maintainability, and inspectability. As each progressive screening level was reviewed, more definitive information on the structural efficiency (weight), manufacturing, and inspection procedures was established to support the design selection. The configuration features that enhance producibility of the final selected design can be used as a generic base for application to other wing panel designs. The selected panel design showed a weight saving of 25 percent over a conventional aluminum design meeting the same design requirements. The estimated cost reduction in manufacturing was 20 percent, based on 200 aircraft and projected 1985 automated composites manufacturing capability. The panel design background information developed will be used in the follow-on tasks to ensure that future panel development represents practical and producible design approaches to graphite/epoxy wing surface panels. A.R.H.

N80-17152# General Dynamics/Convair, San Diego, Calif.
COMPOSITE MATERIAL APPLICATION TO THE MK12A RV MIDBAY SUBSTRUCTURE Final Report, Oct. 1976 - Jul. 1978
W. Garcia, J. Hertz, J. Prunty, and H. McCutchen Sep. 1979 162 p refs
(Contract DAAG46-76-C-0073; DA Proj. 1W1-62113-A-661)
(AD-A076485; CASD/ASC-76-001A; AMMRC-TR-79-51) Avail: NTIS HC A08/MF A01 CSCL 22/2

The work reported herein represents a feasibility study to reduce weight of the MK12A reentry vehicle midbay structure by replacing the aluminum structure with graphite composite materials. Following conceptual design of the MK12A midbay structure utilizing advanced composite materials, the effort was redirected to the Advanced Ballistic Reentry Vehicle (ABRV). Specimens and subcomponent elements representative of the ABRV configuration were provided for nuclear vulnerability and hardness testing of the Air Force Weapons Laboratory. GRA

N80-17222# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF RAPIDLY DEPLOYABLE PLASTIC FOAM SYSTEMS. VOLUME 1: SYSTEM DEVELOPMENT Final Report
Alvin Smith Oct. 1979 41 p refs 2 Vol.
(MIPR-FY1456-78-00006; MIPR-FY1456-79-00002)
(AD-A076332; CERL-TR-M-272-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

Volume 1 of this report (1) presents the findings of a study conducted to develop a low-density polyurethane foam system that is deployable within 5 seconds; and (2) documents a study of foam/fabric deployable shapes. An especially fast-reacting foam formulation was devised, hardware for delivery and mixing of foam chemicals was designed and evaluated, various geometric shapes of constant volume that the foam could be formed into were investigated, and the impact loading characteristics of the foam at various times soon after generation were studied. Fabrication of fabric foam cylinders was also studied. Volume 2 documents a study of fabric-skinned, foam-filled cylindrical beams and an analytical/experimental study of their bending properties. Results of the studies show that a low-density polyurethane foam system that will deploy within 5 seconds is practical to generate and to form into geometrically shaped lightweight fabric bags. The foam exhibits good impact absorption properties very quickly after formation; these properties can be used to attenuate rapidly applied loads of low to intermediate velocities. Finally, the fabric/foam composite beams possess interesting structural qualities commensurate with the fabric and foam used in making them. The analytical and experimental results compare very well. The analysis identified several factors of the mechanics involved that must be included in calculations to predict the loading response of such composites. GRA

N80-17227# Monsanto Research Corp., Dayton, Ohio.
ASSESSMENT OF THE FLAMMABILITY OF AIRCRAFT HYDRAULIC FLUIDS Final Report, 15 Dec. 1975 - 30 Sep. 1978
Leo Parts Wright-Patterson AFB, Ohio AFAPL Jul. 1979 85 p refs
(Contract F33615-76-C-2015; AF Proj. 3048)
(AD-A076512; MRC-DA-860; AFAPL-TR-79-2055) Avail: NTIS HC A05/MF A01 CSCL 11/8

The main thrust of the program was directed toward two objectives: (1) development of apparatus for the measurement of ignitability characteristics of fluids at high temperatures (up to 930 C); and (2) the use of that and other apparatus for the determination of ignitability, flame propagation properties, and heats of combustion of a number of aircraft fluids. These included currently used hydraulic fluids, candidate nonflammable hydraulic fluids, and other aircraft fluids such as lubricants, fuels, and heat transfer fluids. The studies were successful in the identification of candidate nonflammable hydraulic fluids. These fluids were identified as Halocarbon AO-8, Freon E6.5, and Brayco 814Z. A semiautomatic ignition test apparatus was built that can be used for measurements at temperatures up to 1000 C. The operation range of a hot manifold ignition test apparatus was extended up to 930 C. GRA

N80-17242# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
THERMAL OXIDATIVE STABILITY TEST METHODS FOR JPTS JET FUEL Final Report, Jan. 1976 - Dec. 1978
Royce P. Bradley and Charles R. Martel Aug. 1979 53 p refs
(AF Proj. 3048)
(AD-A076374; AFAPL-TR-79-2079) Avail: NTIS HC A04/MF A01 CSCL 21/4

Various samples of Thermally Stable Jet Fuel (JPTS) produced in accordance with military specification MIL-T-25524, were tested for thermal oxidative stability using the Jet Fuel Thermal Oxidation Tester (JFTOT). Two of the fuel samples had marginal thermal stability and provided data needed for the proposed substitution of the JFTOT for the ASTM-CRC Fuel Coker. Over 130 samples of JPTS fuel, submitted for fuel specification compliance test, were tested for thermal oxidative stability using the JFTOT in lieu of the Fuel Coker. The JFTOT, in conjunction with the Alcor Mark 8A Tube Deposit rater, was found to be suitable for the use with JPTS fuels. GRA

N80-17263 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
VIBRATIONS OF A COMPRESSOR BLADE WITH SLIP AT THE ROOT
David I. G. Jones and Agnieszka Muszynska (Polish Academy of Sciences, Warsaw) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 53-61

Avail: NRL, Tech. Inform. Div., Washington D.C.

An analytical model, developed to represent the vibrational behavior of a jet engine compressor blade in its fundamental mode, and which allows for slip at the blade disc interface, is described. The model is applied to a particular blade geometry and the results are compared. The implications of using the model for the design of compressor and turbine blades in order to optimize slip damping levels are discussed. A.W.H.

N80-17265 Sikorsky Aircraft, Stratford, Conn.
DAMPING OF AN ENGINE EXHAUST STACK
John J. DeFelice and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 75-84

Avail: NRL, Tech. Inform. Div., Washington D.C.

A program whose objective was to introduce high damping into the helicopter engine exhaust extension in order to decrease its vibrational amplitude at resonance and thereby increase its fatigue life is described. A specialized high temperature damping material, in the form of vitreous enamel, reported to work effectively over the operational temperature range of the exhaust extension is examined. The application of the high temperature damping materials to the engine exhaust extension and the effect upon the vibrational amplitudes at resonance and component service life are discussed. A.W.H.

N80-17278 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CALCULATION OF NATURAL FREQUENCIES AND MODE SHAPES OF MASS LOADED AIRCRAFT STRUCTURES

P. Wayne Whaley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 13-20

Avail: NRL, Tech. Inform. Div., Washington, D.C.

The problem of loaded random vibration response estimation using Galerkin's method, a direct method, and a generalized coordinates approach is examined. Results indicate that both the direct method and the generalized coordinates solution give very good estimates of the first four modes of a mass loaded simply supported beam, with the generalized coordinates solution giving better accuracy than the direct method. Galerkin's method gives unacceptable results. In addition, a matrix iteration scheme for computing loaded modes, given unloaded modes, is presented. Results show that over 50% reduction in execution time is possible in computing the first four modes, with good accuracy maintained. J.M.S.

N80-17293*# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 3: STRUCTURE MEDIUM INTERACTION, CASE STUDIES IN DYNAMICS
Sep. 1979 97 p refs Presented at the 49th Symp. on Shock and Vibration, Washington, D.C., 17-19 Oct. 1978 Sponsored by NASA. Goddard Space Flight Center 3 Vol.
(NASA-CR-162473; AD-A074701; Bull-49-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 20K

Structure and medium interactions topics are addressed. Topics include: a failure analysis of underground concrete structures subjected to blast loadings, an optimization design procedure for concrete slabs, and a discussion of the transient response of a cylindrical shell submerged in a fluid. Case studies in dynamics are presented which include an examination of a shock isolation platform for a seasparrow launcher, a discussion of hydrofoil fatigue load environments, and an investigation of the dynamic characteristics of turbine generators and low tuned foundations.

N80-17299*# Rockwell International Corp., Los Angeles, Calif.
SELECTED TOPICS FROM THE STRUCTURAL ACOUSTICS PROGRAM FOR THE B-1 AIRCRAFT
Peter M. Belcher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 55-68 refs

Avail: NTIS HC A05/MF A01 CSCL 01C

The major elements of the structural acoustics program for the B-1 aircraft are considered. Acoustic pressures measured at 280 sites on the surface of the vehicle were used to develop pressure models for a resizing of airframe components for aircraft No. 4 (A/C4). Acoustical fatigue design data for two dynamically complex structural configurations were acquired in laboratory programs, the conceptions for and executions of which detailed significant departures from the conventional. Design requirements for mechanical fasteners for configurations other than these two made use of analytical extensions of regrettably limited available information. R.C.T.

N80-17301*# McDonnell Aircraft Co., St. Louis, Mo.
COMBINED VIBRATION/TEMPERATURE/SIDELOAD ENVIRONMENTAL TESTING OF UHF BLADE ANTENNAS

Ronald Volker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 79-84

Avail: NTIS HC A05/MF A01 CSCL 20K

Service problems encountered on the F-4 aircraft showed that the environmental qualification requirements for the UHF blade antenna were not adequate. Although the individual environmental levels were stringent enough, only combined environmental testing could duplicate the conditions in which service problems occurred. Techniques for applying static side load simultaneously with vibration and temperature were developed. The combined environment testing was instrumental in the rapid assessment of antenna modifications and resulted in a final configuration which proved satisfactory in service. A need to include combined environmental testing for qualification of blade antennas was established. Author

N80-17337# Rome Air Development Center, Griffiss AFB, N.Y.
SPREAD-SPECTRUM DATA LINK TEST FACILITY
Oscar H. McKee Aug. 1979 53 p refs
(AD-A075098; RADC-TR-79-244) Avail: NTIS HC A04/MF A01 CSCL 09/5

This technical report describes the development of an in-house capability for evaluating wide bandwidth spread spectrum modems. The major portion of the report concerns the development and fabrication of the microwave transmitting and receiving equipment used during the flight testing of a direct sequence spread spectrum modem developed to RADC specifications. The microwave equipment developed for the test facility operated at an IF of 300 MHz, with four distinct RF frequencies of 4500 MHz, 4900 MHz, 7350 MHz and 7900 MHz. The output power for all stations was set at 200 watts CW, however, additional power is available at the three ground stations. Section 2 of the report presents the theoretical calculations used to predict the maximum range expected from each of four data links incorporated in a five station test scenario. The maximum theoretical range was calculated to be 414.3 miles, however, the ranges achieved during actual flight testing were approximately 9 dB below theoreteical expectations. GRA

N80-17348# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
MEASUREMENT OF RADIATION PATTERNS OF AIRCRAFT ANTENNAS IN NON-STEADY FLIGHT
D. C. Schering and H. Tellegen 10 Feb. 1979 28 p refs
(NLR-TR-78018-U) Avail: NTIS HC A03/MF A01

Methods for measuring radiation patterns of aircraft antennas are described. During pitch and roll maneuvers radiation in the symmetry respective lateral plane of the aircraft is recorded. Diagrams of the horizontal plane are obtained by a semi-stationary method; a circular track with wings level is flown at a relatively large distance from the ground station. During the

time that the maneuvers are being carried out only small parts of the ground antenna diagram are needed and the effect of the shape of this pattern is reduced to a scale factor; the brief time involved also minimizes the influence of a varying distance, changes in environment conditions, and of equipment characteristics. The effect of reflection from the Earth's surface is reduced by the use of an artificial ground plane and by optimization of the configuration of the receiving antennas. The methods were applied to a Fokker F-27 transport aircraft in a version containing nine different aerials. A fair reduction in flying time is obtained over the well-known standard method of 'flying along'.
Author (ESA)

N80-17357# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
FIELD IMPACT EVALUATION REPORT ON THE ELECTRONIC TABULAR DISPLAY SUBSYSTEM (ETABS) Final Report, Dec. 1978 - Jul. 1979
Oct. 1979 52 p
(AD-A078848; FAA-RD-79-101) Avail: NTIS HC A04/MF A01 CSCL 14/2

A team of field personnel from air traffic and airways facilities conducted an impact assessment of the projected implementation of the electronic tabular display subsystem (ETABS) at air route control center. Alternatives were developed which could be expected to reduce or eliminate the negative consequences identified which could result from ETABS implementation. Six impact areas are addressed. These are: impact on the workforce, technological considerations, implementation, operations, training, and logistics support. Conclusions and recommendations as to the most desirable alternative solutions from a field viewpoint are presented. A.R.H.

N80-17366# Thermal Technology Labs., Buffalo, N. Y.
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES Final Report, Jul. 1976 - Mar. 1979
James P. Welsh Jun. 1979 69 p refs
(Contract F33615-75-C-2014; AF Proj. 3145)
(AD-A076215; AFAPL-TR-79-2049) Avail: NTIS HC A04/MF A01 CSCL 09/5

Emphasis on this program was on the development of high voltage, high power, high frequency, low specific weight, inverter transformers. A primary intent was the reduction of specific weight without sacrifice of either electrical performance or reliability. Research was conducted into the characteristics of magnetic and dielectric materials, improved magnetic circuit modeling, and application of advanced heat transfer techniques. Computer-aided design methods were utilized and specialized programs were developed to permit extensive manipulation of multiple design parameters. GRA

N80-17397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF A CERAMIC COATING ON METAL TEMPERATURES OF AN AIR-COOLED TURBINE VANE
Herbert J. Gladden and Curt H. Liebert Feb. 1980 29 p refs
(NASA-TP-1598; E-167) Avail: NTIS HC A03/MF A01 CSCL 20D

The metal temperatures of air cooled turbine vanes both uncoated and coated with the NASA thermal barrier system were studied experimentally. Current and advanced gas turbine engine conditions were simulated at reduced temperatures and pressures. Airfoil metal temperatures were significantly reduced, both locally and on the average, by use of the the coating. However, at low gas Reynolds number, the ceramic coating tripped a laminar boundary layer on the suction surface, and the resulting higher heat flux increased the metal temperatures. Simulated coating loss was also investigated and shown to increase local metal temperatures. However, the metal temperatures in the leading edge region remained below those of the uncoated vane tested at similar conditions. Metal temperatures in the trailing edge region exceeded those of the uncoated vane. K.L.

N80-17401# Naval Postgraduate School, Monterey, Calif.
MEASUREMENTS OF JET DISPERSIONS SIMULATED IN AN AERONAUTICAL WIND TUNNEL M.S. Thesis
J. V. Brendmoen Sep. 1979 94 p refs
(AD-A076578) Avail: NTIS HC A05/MF A01 CSCL 13/2

A neutrally stable atmospheric surface layer was suitably simulated in a low speed wind tunnel by tripping the boundary layer with a fence and letting the turbulent flow develop over a length of roughness elements. Jet exhaust dispersion characteristics, simulated by a burner/nozzle system, were investigated by measuring the horizontal and vertical temperature profiles at axial stations downwind from the nozzle exit. Dispersion sensitivity to different nozzle exit conditions, angles of incidence to the wind, the nozzle surface blockage were investigated. The results were compared to disperison methods used in the Air Quality Assessment Model (AQAM). It was found that the experimental jet penetration length was much shorter than that assumed in AQAM, and that a plume rise existed, which is not included in the current AQAM model. Required inputs of the initial dispersion coefficients were determined as a function of wind direction. GRA

N80-17422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE STRENGTH TESTING EMPLOYED FOR EVALUATION AND ACCEPTANCE OF JET-ENGINE INSTRUMENTATION PROBES
Everett C. Armentrout 1980 25 p refs Presented at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME
(NASA-TM-81402; E-313) Avail: NTIS HC A02/MF A01 CSCL 14B

The fatigue type testing performed on instrumentation rakes and probes intended for use in the air flow passages of jet engines during full scale engine tests is outlined. A discussion of each type of test performed, the results that may be derived and means of inspection is included. R.E.S.

N80-17482# Centre Technique des Industries Mecaniques, Senlis (France).
PREDICTION OF DYNAMIC PROPERTIES OF A ROTOR SUPPORTED BY HYDRODYNAMIC BEARINGS USING THE FINITE ELEMENT METHOD Final Report
J. Peigney 19 Sep. 1979 30 p refs Presented at Intern. Conf. on Eng. Appl. of the Finite Element Method, Oslo, May 1979
(CETIM-1-4A-29-0) Avail: NTIS HC A03/MF A01

General programs for rotor bearing analysis using the finite element method are presented. A consistent representation of both mass and stiffness is used for the rotor shaft while hydrodynamic bearings are calculated by solving a Reynolds equation. Dynamic characteristics of these bearings are then obtained with a perturbation method. These programs are compared with both numerical and experimental results from the literature and agreement is shown to be good. The influence of bearing characteristics on the stability threshold and the unsteady response of a rotor are also studied. Author (ESA)

N80-17495# Villanova Univ., Pa. Dept. of Mechanical Engineering.
AEROSTRUCTURE NONDESTRUCTIVE EVALUATION BY THERMAL FIELD TECHNIQUES Final Report, 17 Mar. 1978 - 17 Jan. 1979
P. V. McLaughlin, Jr., E. V. McAssey, Jr., and R. C. Deitrich 1 Nov. 1979 40 p refs
(Contract N68335-78-M-5337)
(AD-A076541; NAEC-92-131) Avail: NTIS HC A03/MF A01 CSCL 14/2

Certain types of flaws and damage in composite materials are not readily observable by visual examination. Examples of these are delaminations, blindside impact damage, and sub-surface laminar cracks. Programs are currently underway to develop

methods of detecting such flaws by many techniques, among which are X-ray, neutron radiography, ultrasonic transmission and reflectance, eddy current, and thermography. This report describes results of an experimental and analytical research investigation to evaluate infrared thermography as an NDE tool to locate structural damages which are not easily located by visual examination. Also discussed are possible applications to aluminum structures. GRA

N80-17506# Aeronautical Research Labs., Wright-Patterson AFB, Ohio.
THE FRACTURE OF A PARACHUTE HOOK: A CASE STUDY OF THE ROLE OF MATERIALS PARAMETERS IN RELIABILITY ANALYSIS
L. R. F. Rose and B. J. Wicks 1979 28 p refs
(ARL-MAT-Note-125; AR-001-591) Avail: NTIS HC A03/MF A01

A detailed analysis of the risk of failure for the particular case of a parachute hook is used to illustrate what information is required for that purpose, how much of it is readily available, and in what areas further research is needed. The analysis relies on the use of a full scale test to identify the mode of failure and hence the relevant strength parameter. It is concluded that an important role of materials research is to provide an understanding of the factors which can affect mechanical properties, so that the characteristics of the relevant population of structures or components may be more precisely defined, and the variability in strength which can be expected in service may be estimated. A number of topics for further research are discussed, but the practical value of this research will depend on the precision of the results obtained and this cannot be determined beforehand. Author

N80-17508# National Aerospace Lab., Amsterdam (Netherlands).
ADDITIONAL INFORMATION ABOUT FALSTAFF
J. B. DeJonge 6 Dec. 1979 13 p refs
(NLR-TR-79056-U; ICAF-1133) Avail: NTIS HC A02/MF A01

The defining properties are described for a standard load sequence considered representative of the load time history in the lower wing skin near the wing root of a fighter aircraft. The complete FALSTAFF sequence of numbers, ranging from 1 to 32, represents 200 'flights', and consists of 35966 numbers equally distributed over peaks and troughs. The program does not define the way, both with regard to shape and time, in which the load varies between a trough and a peak. The complete Markov-matrix plus tabulations and level crossings pertaining to the FALSTAFF-sequence are presented. A.R.H.

N80-17509# Boeing Co., Wichita, Kans.
EVALUATION OF THE CRACK GAGE CONCEPT FOR MONITORING AICRAFT FLAW GROWTH POTENTIAL, VOLUME 2 Final Report, 1 Jul. 1977 - 1 Dec. 1978
Gary G. Cassatt Jun. 1979 262 p
(Contract F33615-77-C-5023)
(AD-A076320; AFML-TR-79-4037-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 01/3

The results of a test program to evaluate the ability of a bonded-on precracked coupon to monitor the growth of flaws in the basic structure are included. All testing utilized 7075-T651 aluminum from a single plate. Both constant thickness and stepped crack gages were evaluated. Evaluation of a wide range of sensitivity in crack gage crack growth response was made. Structure flaws of (1) corner flaw at a hole, (2) through flaw at a hole, and (3) center notch flaw were evaluated. The cyclic test loading included constant amplitude of two R ratios and three representative aircraft usage flight profiles. Strain gage instrumentation was used to measure structure stresses and load transferred into the crack gages. GRA

N80-17510# Boeing Co., Wichita, Kans.
EVALUATION OF THE CRACK GAGE CONCEPT FOR MONITORING AIRCRAFT FLAW GROWTH POTENTIAL. VOLUME 1. TECHNICAL DISCUSSION Final Report, 1 Jul. 1977 - 1 Dec. 1978
Gary G. Cassatt Jun. 1979 112 p refs
(Contract F33615-77-C-5073)
(AD-A076421; AFML-TR-4037 Vol-1) Avail: NTIS HC A06/MF A01 CSCL 01/3

The results of a test program to evaluate the ability of a bonded on precracked coupon to monitor the growth of flaws in the basic structure are included. All testing utilized 7075-T651 aluminum from a single plate. Both constant thickness and stepped crack gages were evaluated. Evaluation of a wide range of sensitivity in crack gage crack growth response was made. Structure flaws of, (1) corner flaw at a hole, (2) through flaws at a hole and (3) center notch flaw were evaluated. The cyclic test loading included constant amplitude of two R ratios and three representative aircraft usage flight profiles. Strain gage instrumentation was used to measure structure stresses and load transferred into the crack gages. GRA

N80-17518# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft u. Raumfahrt.
COLLECTION AND ANALYSIS OF IN SERVICE FLIGHT HISTORIES OF THE INITIATION OF FATIGUE DAMAGE [SAMMLUNG UND ANALYSE VON IM BETRIEB VON LUFTFAFR ZEUGEN AUFGETRETENEN ERMUEDUNGSSCHAEDEN]
H. Huth and D. Schuetz Bonn Dokzewtbw Apr. 1979 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF43/RF-430/51038)
(BMVG-FBWT-79-10) Avail: NTIS HC A03/MF A01; Dokzentbw, DM 30

In-service aircraft failure histories are evaluated in order to show weak points of design and causes of early fatigue inititation. The distribution and frequency of fatigue cracks in the different structural components show that the main problem is in the joints. The crack lengths of service and test failures at the time of detection are also evaluated. The principal causes of damage are found to be excessive load transfer, double stress concentration, design stress, induced deflections, secondary bending, sharp edge, open hole, and production defects. These causes are explained using examples taken from the collection of cracks. Author (ESA)

N80-17519# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
ON THE FATIGUE LIFE EVALUATION OF JOINTED SPECIMENS UNDERGOING LOAD TRANSFER WITH REGARD TO STRESS CONCENTRATION [ZUR LEBENSDAUERABSCHAETZUNG VON FUEGUNGEN MIT SCHUBBEANSPRUCHTEN BEFESTIGUNGSELEMENTEN UNTER BERUECKSICHTIGUNG DER LASTUEBERTRAGUNG]
J. Franz and D. Schuetz Bonn Dokzentbw Apr. 1979 96 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-43/RF-430/51038)
(BMVG-FBWT-79-11) Avail: NTIS HC A05/MF A01; Dokzentbw, DM 30

The methods of fatigue life evaluation for jointed parts in aircraft structures show great uncertainties, a fact which is indicated by the numerous and in many cases early occurences of fatigue failures in such components. These uncertainties are caused by the insufficient consideration of important parameters, which influence fatigue life decisively, during the design phase. The influence of two parameters, load transfer, and secondary bending stresses, on the fatigue life of jointed specimens were investigated. Results show that for the performance of a reliable fatigue life evaluation, it is important to determine the load transfer and the secondary bending stresses either theoretically or experimentally (as in the case of an already existing construction). If load transfer, and secondary bending stresses are known, more detailed methods are applicable for fatigue life evaluation which enables a more optimal design of joints to be made in consideration of fatigue. Author (ESA)

N80-17521# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

ON INTERFACING STRUCTURAL INFORMATION AND LOADING DATA IN AEROELASTIC ANALYSIS

Dorothy Holford and J. C. Copley London HMSO May 1977 86 p refs Supersedes RAE-TR-77-074; ARC-37619 (ARC-R/M-3833; ISBN-0-11-471166-6; BR68824; RAE-TR-77-074; ARC-37619) Avail: NTIS HC A05/MF A01; HSMO £8.00; PHI

A systematic means of interfacing structural and loading information in aeroelastic analyses is developed and a computer implementation, with particular application to plate-like structures, is described. Various numerical examples of the use of the method are given, and the overall accuracy of the procedure advocated is critically examined. The proposed FORTRAN subroutine produces a flexibility matrix which purports to relate either displacement or a spatial derivative of displacement at a set of points to loads at a second set of points. Results show that so long as the displacements, as calculated from the derived matrix, do not resemble those of an eigenvector of that matrix which is associated with a relatively low flexibility (viewed in relation to the number and distribution of points in the two sets) then they are likely to be of an acceptable accuracy.

Author (ESA)

N80-17824# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.

RESEARCH ON HELICOPTER ROTOR NOISE Final Report, 1 Jun. 1976 - 30 Sep. 1979

H. Liebowitz and F. Farassat Oct. 1979 13 p refs (Grants DAAG29-78-G-0152; DAAG29-76-G-0259) (AD-A075259; ARO-13517.3-EX) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report summarizes the results of studies in the following areas: (1) applications of generalized functions to aeroacoustics and aerodynamic problems, (2) bounds on thickness and loading noise of rotating blades and the effects of blade sweep on reduction of the noise of rotating blades, (3) study of nonlinear effects relevant to the rotor noise problem and (4) computational aspects of high speed rotor noise.

GRA

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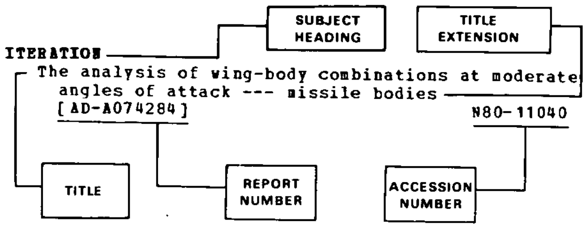

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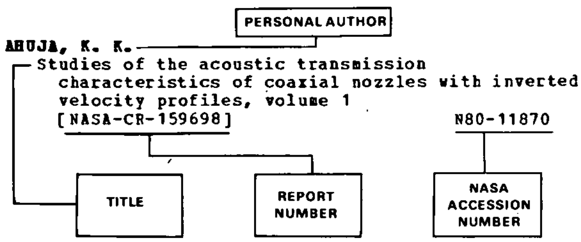

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